

Instruction Manual

748221-M
July 2002

Model 7D

Thermal Conductivity Analyzer



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ESSENTIAL INSTRUCTIONS

READ THIS PAGE BEFORE PROCEEDING!

Rosemount Analytical designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you **MUST properly install, use, and maintain them** to ensure they continue to operate within their normal specifications. The following instructions **MUST be adhered to** and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- **Read all instructions** prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, **contact your Rosemount Analytical representative** for clarification.
- **Follow all warnings, cautions, and instructions** marked on and supplied with the product.
- **Inform and educate your personnel in the proper installation, operation, and maintenance of the product.**
- **Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes.** Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, **use qualified personnel** to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, **and VOID YOUR WARRANTY.** Look-alike substitutions may result in fire, electrical hazards, or improper operation.
- **Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.**

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PREFACE

The purpose of this manual is to provide information concerning the components, functions, installation and maintenance of the Model 7D.

Some sections may describe equipment not used in your configuration. The user should become thoroughly familiar with the operation of this module before operating it. Read this instruction manual completely.

DEFINITIONS

The following definitions apply to DANGERS, WARNINGS, CAUTIONS and NOTES found throughout this publication.

DANGER

Highlights the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.

WARNING

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in injury, death, or long-term health hazards of personnel.

CAUTION

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in damage to or destruction of equipment, or loss of effectiveness.

NOTE

Highlights an essential operating procedure, condition or statement.

INTENDED USE STATEMENT

The Model 7D is intended for use as an industrial process measurement device only. It is not intended for use in medical, diagnostic, or life support applications, and no independent agency certifications or approvals are to be implied as covering such application.

SAFETY SUMMARY

If this equipment is used in a manner not specified in these instructions, protective systems may be impaired.

AUTHORIZED PERSONNEL

To avoid explosion, loss of life, personal injury and damage to this equipment and on-site property, all personnel authorized to install, operate and service the this equipment should be thoroughly familiar with and strictly follow the instructions in this manual. **SAVE THESE INSTRUCTIONS.**

DANGER

ELECTRICAL SHOCK HAZARD

Do not operate without doors and covers secure. Servicing requires access to live parts which can cause death or serious injury. Refer servicing to qualified personnel.

For safety and proper performance this instrument must be connected to a properly grounded three-wire source of power.

Before supplying electrical power to the analyzer, remove power to the bridge by disconnecting the red lead from the bridge to TB1-1 or TB1-2 (depending on the bridge polarity). See drawing 654642. To safeguard against filament damage, this lead should remain disconnected until proper gas flow has been established.

WARNING

ELECTRICAL SHOCK HAZARD

Do not operate the Model 7D Explosion-Proof Analyzer without the lens cover and door in place with all bolts secured, unless location have been determined to be non-hazardous.

WARNING

POSSIBLE EXPLOSION HAZARD

Ensure that all gas connections are made as labeled and are leak free. Improper gas connections could result in explosion or death.

WARNING

POSSIBLE EXPLOSION HAZARD

This analyzer is of a type capable of analysis of sample gases which may be flammable. If used for analysis of such gases, the instruments explosion-proof enclosure must be suitable for the gas.

If explosive gases are introduced into this analyzer, the sample containment system must be carefully leak-checked upon installation and before initial startup, during routine maintenance and any time the integrity of the sample containment system is broken, to ensure the system is in leak-proof condition. Leak-check instructions are provided in Section 2-4 on page 2-3.

Internal leaks resulting from failure to observe these precautions could result in an explosion causing death, personal injury or property damage.

CAUTION

PRESSURIZED GAS

This analyzer requires periodic calibration with known zero and standard gases. See General Precautions for Handling and Storing High Pressure Gas Cylinders, page P-4

CAUTION

PARTS INTEGRITY

Tampering or unauthorized substitution of components may adversely affect safety of this product. Use only factory documented components for repair.

GENERAL PRECAUTIONS FOR HANDLING AND STORING HIGH PRESSURE GAS CYLINDERS

Edited from selected paragraphs of the Compressed Gas Association's "Handbook of Compressed Gases" published in 1981

**Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, Virginia 22202**

Used by Permission

1. Never drop cylinders or permit them to strike each other violently.
2. Cylinders may be stored in the open, but in such cases, should be protected against extremes of weather and, to prevent rusting, from the dampness of the ground. Cylinders should be stored in the shade when located in areas where extreme temperatures are prevalent.
3. The valve protection cap should be left on each cylinder until it has been secured against a wall or bench, or placed in a cylinder stand, and is ready to be used.
4. Avoid dragging, rolling, or sliding cylinders, even for a short distance; they should be moved by using a suitable hand-truck.
5. Never tamper with safety devices in valves or cylinders.
6. Do not store full and empty cylinders together. Serious suckback can occur when an empty cylinder is attached to a pressurized system.
7. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). A flame should never be permitted to come in contact with any part of a compressed gas cylinder.
8. Do not place cylinders where they may become part of an electric circuit. When electric arc welding, precautions must be taken to prevent striking an arc against the cylinder.

DOCUMENTATION

The following Model 7D instruction materials are available. Contact Customer Service Center or the local representative to order.

748221 Instruction Manual (this document)

COMPLIANCES

The explosion-proof Model 7D is approved by Factory Mutual Research Corp. (FMRC) for installation in Class I, Groups B, C, and D, Division 1 hazardous locations as defined in the National Electrical Code (NEC), ANSI/NFPA-70.



APPROVED

Instruction Manual

748221-M
July 2002

Model 7D

SECTION 1

DESCRIPTION AND SPECIFICATIONS

1-1 OVERVIEW

The Model 7D Thermal Conductivity Analyzer is designed to continuously measure the concentration of a single component of interest in a flowing gas mixture. The measurement is based on the different thermal conductivity's of the individual components of the sample stream. The method is especially well suited to analysis of two-component sample streams. However, analysis of multi-component streams is possible if the various components of the background gas occur in relatively constant ratio, or have similar thermal conductivity's.

Each Model 7D Analyzer is factory-assembled, as ordered, for determination of a specified component, with specified range of concentration, contained in a background component or background mixture of known composition. Typical examples include: 0 to 100 % hydrogen in nitrogen; 20 to 50 % helium in methane; and 0% to 3% carbon dioxide in air. If so ordered, the instrument is provided with two or three ranges; selectable via a front-panel switch. Information specific to the individual instrument is provided in the Data Sheet in the rear of this manual inserted in the back of this instruction manual.

A Model 7D Analyzer consists of an analyzer module, Section 1-2 below, and, if ordered, an accessory gas selector panel, Section 1-3 on page 1-4.

1-2 ANALYZER MODULE

The analyzer module is supplied in an explosion-proof enclosure suitable for installation in hazardous locations classified as Class I, Division 1, Groups B, C, and D per the National Electrical Code (ANSI/NFPA 70) (See DWG 654625).

a. Thermal Conductivity Cell

The thermal conductivity cell is a metal block with separate passages for the

sample and reference gases. In all applications, the sample passage receives a continuous flow of sample gas. Depending on the application, the reference passage may receive a continuous flow of reference gas, or may have the reference gas sealed within.

The sample passage contains a pair of temperature-sensitive resistive filaments. The reference passage contains a similar pair. Electrically, the filaments are connected as legs of a Wheatstone bridge. An internal voltage-regulated power supply is connected via a 20-ohm dropping resistor, to the bridge.

With the power supply output adjusted to provide an appropriate voltage across the bridge, an electric current flows through the filaments, heating them and thus increasing their electrical resistance. The heat-dissipation rate for each filament depends on the thermal conductivity of the surrounding gas.

Initially, with suitable downscale calibration gas flowing through the sample passage (and also through the reference passage if of the flow-through configuration), the bridge is balanced. Thereafter, any change in the relative proportions of the components passing through the sample passage changes the thermal conductivity of the gas mixture, causing a temperature differential between sample and reference filaments. The resultant change in filament resistance unbalances the bridge, applying a signal to the electronic circuitry (Section 1-2b on page 1-3).

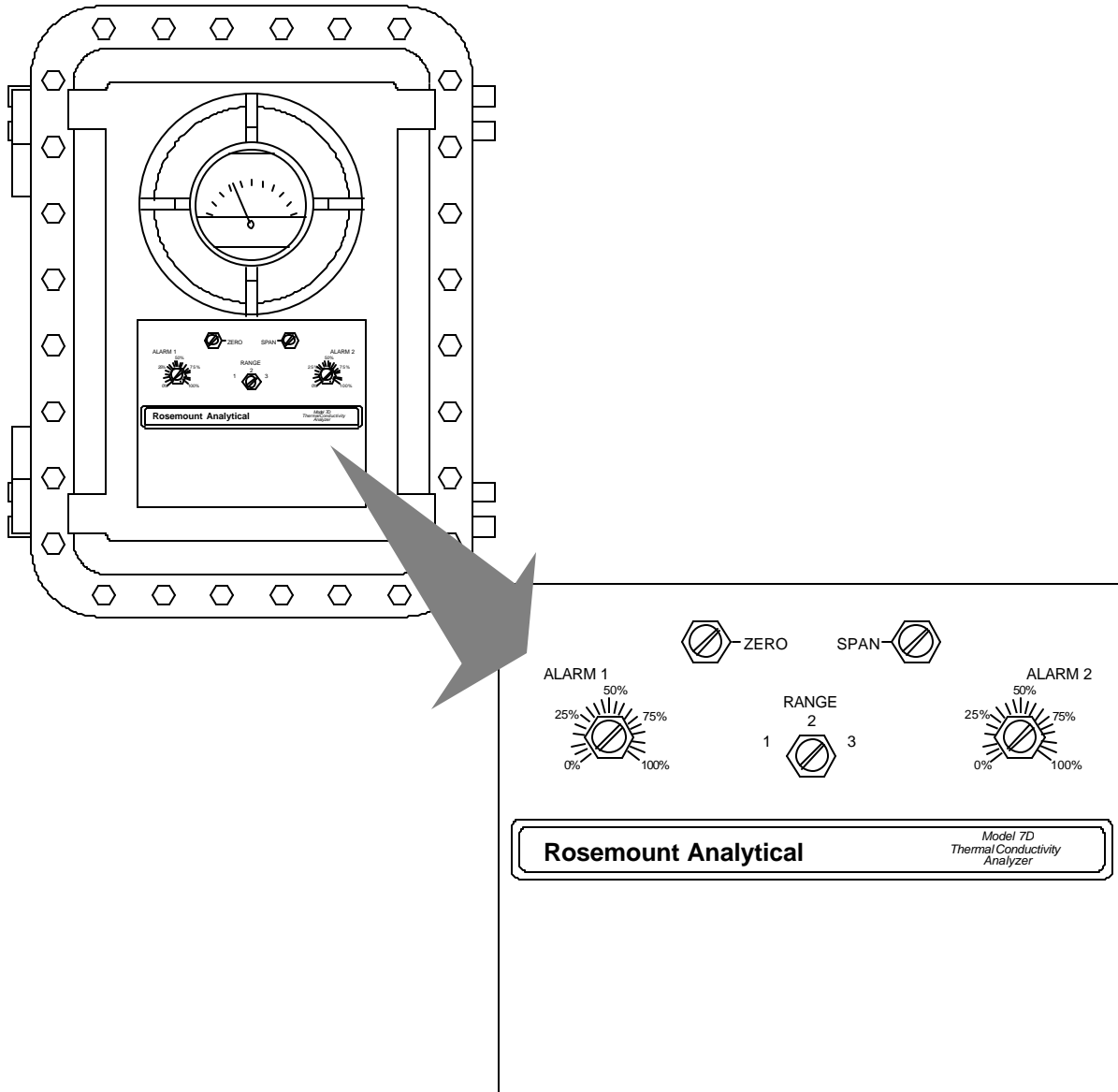


Figure 1-1. Model 7D Front Panel Controls

b. Electronic Circuitry

The analyzer module contains solid-state circuitry that conditions the bridge-imbalance signal as required to provide readout on the front-panel meter. In addition, a field-selectable output for a voltage-type recorder is provided as standard. A field-selectable output of 4 to 20 mA for a current-actuated recorder or other device is obtainable through use of an optional plug-in circuit board. A calibration curve can be used to convert meter or recorder readings into

concentration values. Typical calibration curves are supplied for standard ranges. Calibration curves for special ranges are available as options.

To avoid use of a calibration curve in an application where it would otherwise be required, the analyzer may be equipped with an optional linearizer board. If so, the linearizer is factory set for a given range only, and is not usable on another range. Note that a linearizer is usable only if nonlinearity at midscale does not exceed approximately 20% of fullscale.

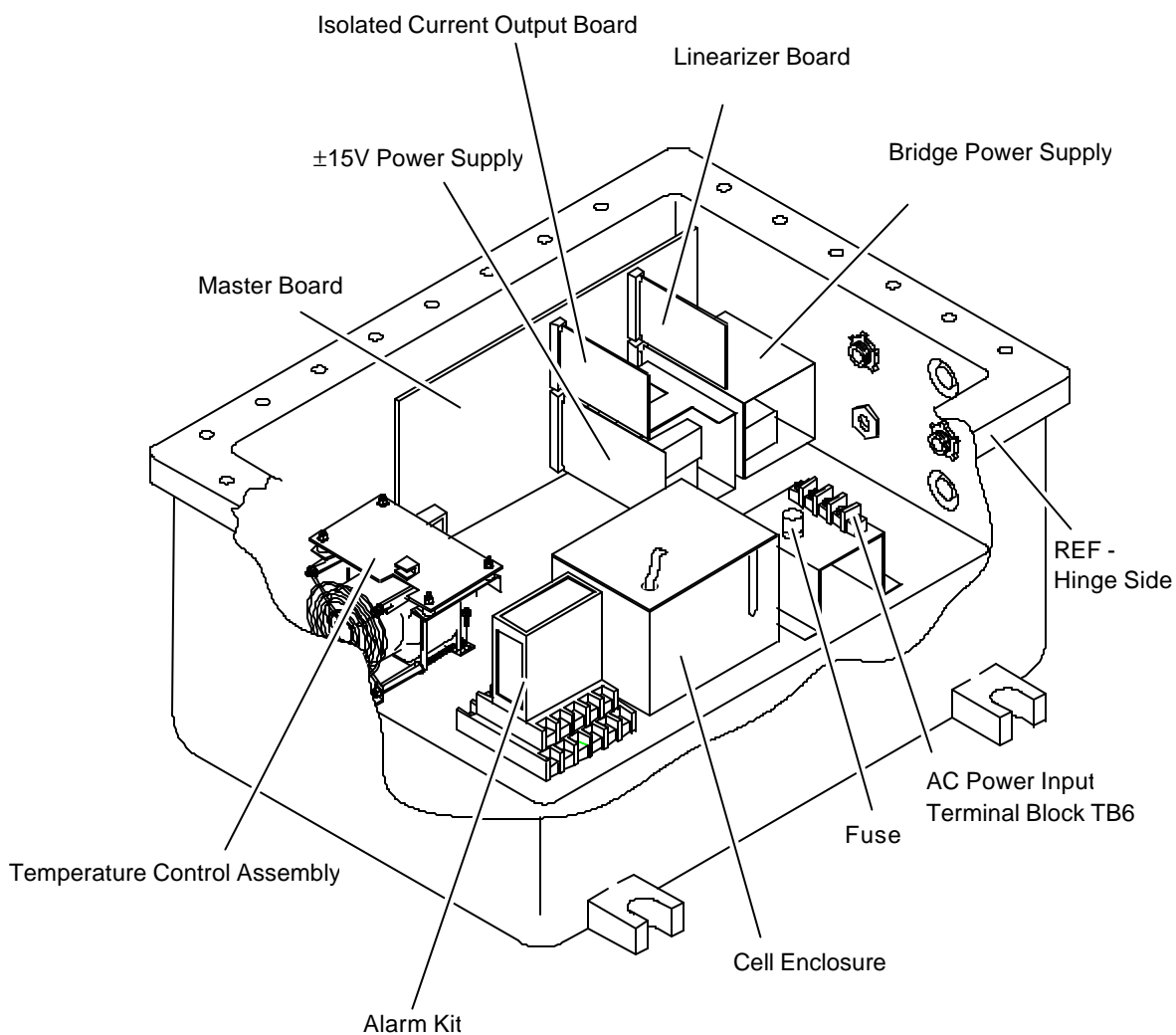
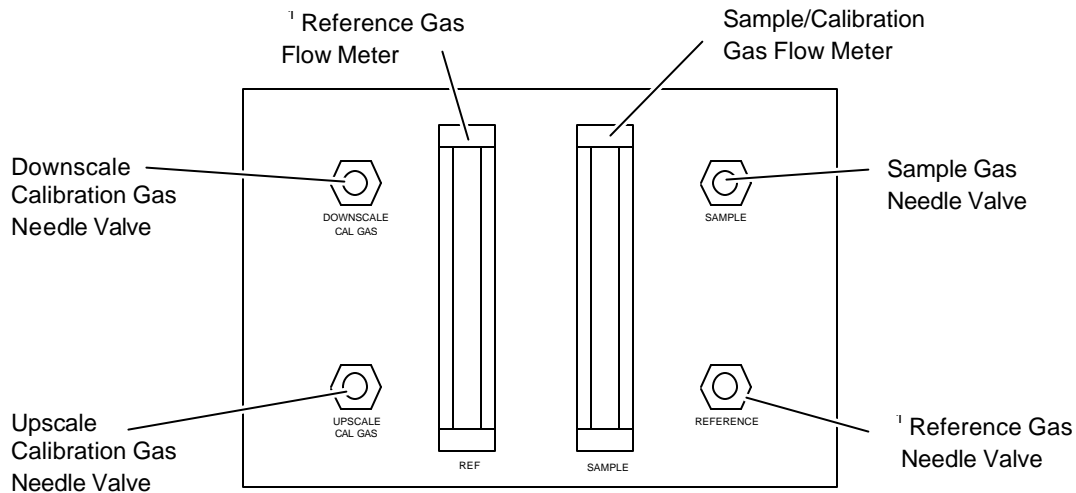


Figure 1-2. Model 7D – Location of Major Components

1-3 GAS SELECTOR PANEL

If so ordered, the analyzer module is provided with an appropriate gas selector panel, Figure 1-3 below. The gas selector panel permits selection, flow adjustment, and flow measurement for the various gases: sample; flowing reference gas, if used; and downscale and upscale calibration gases. Proper choice of a gas selector panel depends on:

1. Configuration of the thermal conductivity cell, i.e., flowing or sealed-in reference gas.
2. Composition of the sample stream. For non-corrosive streams, the gas selector panel is assembled with brass components. For corrosive streams, stainless steel is used.



¹ Provided only if thermal conductivity cell uses flowing reference gas.

Figure 1-3. Typical Gas Selector Panel

DESCRIPTION	PART NUMBER
Brass and Copper construction for use with sealed reference	113357
Stainless steel construction for use with sealed reference	113920
Brass and Copper construction for use with flowing reference	117195
Stainless steel construction for use with flowing reference	118210

Table 1-1. Available Gas Selector Panels

Model 7D

1-4 SPECIFICATIONS

Reproducibility.....	±0.5% of fullscale
Zero Drift ¹	±1% of fullscale per 24 hours
Span Drift ¹	±1% of fullscale per 24 hours
Noise.....	Less than ±0.5% of fullscale
Cell Response Time ²	30 seconds for 95% response, with sample flow of 250 cc/min.
Sample Flow.....	Nominal, 50 to 350 cc/min; recommended, 250 cc/min.
Calibration Gas Flow.....	Nominal, 50 to 350 cc/min; recommended, 250 cc/min.
Reference Gas Flow (If Req'd).....	5 to 50 cc/min.
Supply Pressure.....	10 to 50 psig (69 to 345 kPa)
Meter.....	Indicating analog meter is standard.
Operating Ranges.....	Various zero-based and zero-suppressed ranges, from 0% to 100%, are available. Single range is standard; switch-selectable dual or triple range is optional.
Ambient Temperature Range.....	32°F to 100°F (0°C to 38°C). Case Temperature controlled at 117°F (47°C).
Output Voltage	
Standard Non-Linearized.....	Switch selectable: 0 to 10 mV, 0 to 100 mV, 0 to 1V or 0 to 5V DC
Optional Linearized.....	Switch selectable: 0 to 10 mV, 0 to 100 mV, 0 to 1V or 0 to 5V DC
Isolated Current Output (Option)...	4 to 20 mA, maximum load 1500 ohms
Dual Alarms (Option).....	Relay contact rating: 1.0 A, 120V AC; 5.0 A, 120V DC, resistive loads
Cell Materials (Standard Cell)	316 stainless steel block with tungsten or Hitempco filaments. Corrosion-resistant filaments available on order
Power Requirements.....	115/230 VAC ±10%, 50/60 Hz, 250 Watts
Enclosure.....	Class I, Groups B, C and D, Division 1 hazardous locations (ANSI/NFPA 70)

¹ Zero and Span drift specifications based on ambient temperature shifts of less than 18 Fahrenheit degrees (10 Celsius degrees) at a maximum rate of 18 Fahrenheit degrees (11 Celsius degrees) per hour.

² Cell response time is less than 45 seconds for 95% response, with sample flow rate of 250 cc/min, for the following gas combinations: Argon and air, nitrogen, or oxygen; carbon dioxide and argon, nitrogen, or oxygen; helium and methane; hydrogen and methane.

SECTION 2 INSTALLATION

2-1 FACILITY PREPARATION

Sections 2-1a through 2-1d provide information that may be required prior to installation.

a. Installation Drawings

For outline and mounting dimensions of the analyzer and gas selector panel modules, refer to drawing 654625 and Figure 2-1 on page 2-2 or Figure 2-2 on page 2-3.

b. Customer Electrical Connections

Customer electrical connections are shown in Figure 2-5 on page 2-6.

c. Flow Diagrams

For gas connections, refer to appropriate flow diagram:

- Analyzer using sealed reference gas, Figure 2-3 on page 2-4
- Analyzer using flowing reference gas, Figure 2-4 on page 2-5.

d. Location and Mounting

Location

Proper location for the analyzer depends on two basic considerations:

- Accessibility to the sampling point
- Protection of the instrument

Ideally, the analyzer should be located as close to the sampling point as possible. Short sample lines reduce time lag in readings. In practice, however, protection of the instrument sometimes calls for more remote placement.

The analyzer should be mounted in a clean, dry atmosphere. Ambient temperature should be within the range of 32°F to 100 F (0°C to 38°C).

Mounting

The analyzer is designed for surface mounting, utilizing the hardware provided. Refer to drawing 654625.

2-2 UNPACKING

The Model 7D Thermal Conductivity Analyzer is a precision instrument and should be handled carefully. Carefully examine the shipping carton and contents for signs of damage. Immediately notify the carrier if the carton or its contents are damaged. Retain the carton and packing material until the instrument is operational.

2-3 GAS REQUIREMENTS

a. General

The Model 7D requires cylinder gases appropriate to the particular application (refer to the Data Sheet inserted in the rear of this manual). Suitable gases are available from various suppliers.

b. Calibration Gas Requirements

For calibration, the analyzer requires a downscale and an upscale calibration gas, both normally specified in the Data Sheet in the rear of this manual. Proper choice of calibration gases for a particular application depends on the composition of the sample stream and the operating range used.

c. Sample Gas Composition

In a typical application, the sample gas consists of two components, for example: hydrogen in nitrogen. In this example,

hydrogen is designated the “measured component” and nitrogen constitutes the “background gas.”

d. Suppressed-Zero Ranges

With any zero-suppressed range, the zero-concentration point for the measured component lies offscale, below the lower range-limit. A typical example is 80% to 100% hydrogen in nitrogen. Here the appropriate upscale calibration gas would be pure hydrogen. The downscale gas would have a composition appropriate to establishing a calibration point slightly above the lower range-limit e.g., 81% hydrogen in nitrogen.

WARNING
POSSIBLE EXPLOSION HAZARD
This analyzer is of a type capable of analysis of sample gases which may be flammable. If used for analysis of such gases, the instruments explosion-proof enclosure must be suitable for the gas.
If explosive gases are introduced into this analyzer, the sample containment system must be carefully leak-checked upon installation and before initial startup, during routine maintenance and any time the integrity of the sample containment system is broken, to ensure the system is in leak-proof condition.
Internal leaks resulting from failure to observe these precautions could result in an explosion causing death, personal injury or property damage.

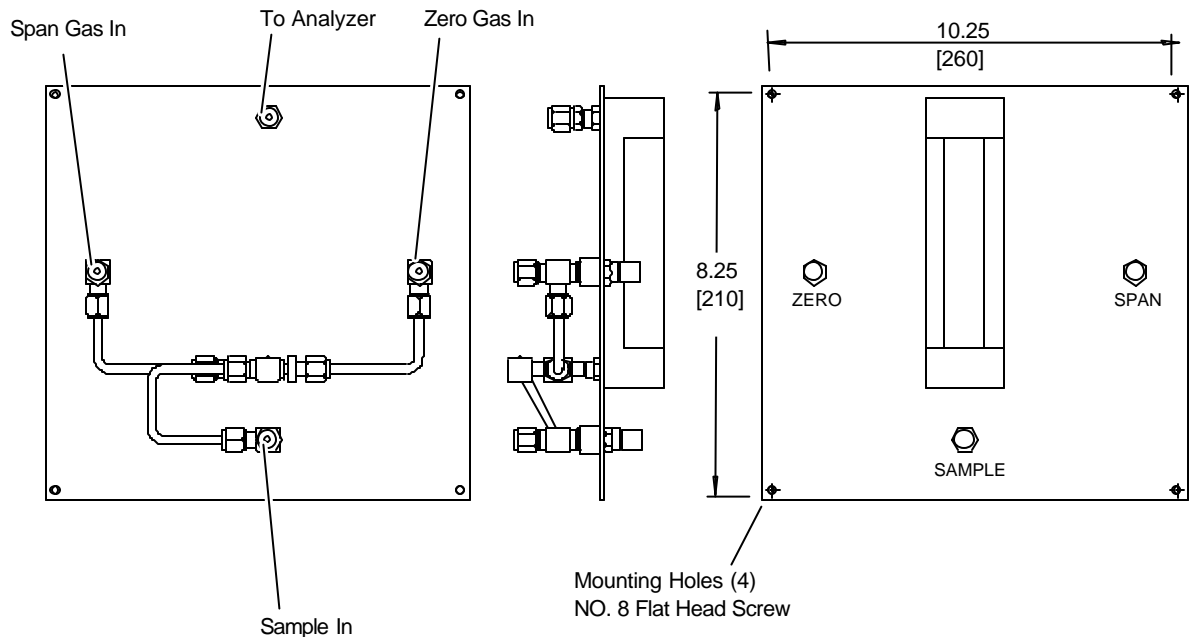


Figure 2-1. Gas Selector Panel for Thermal Conductivity Cell with Sealed-In Reference Gas

Model 7D

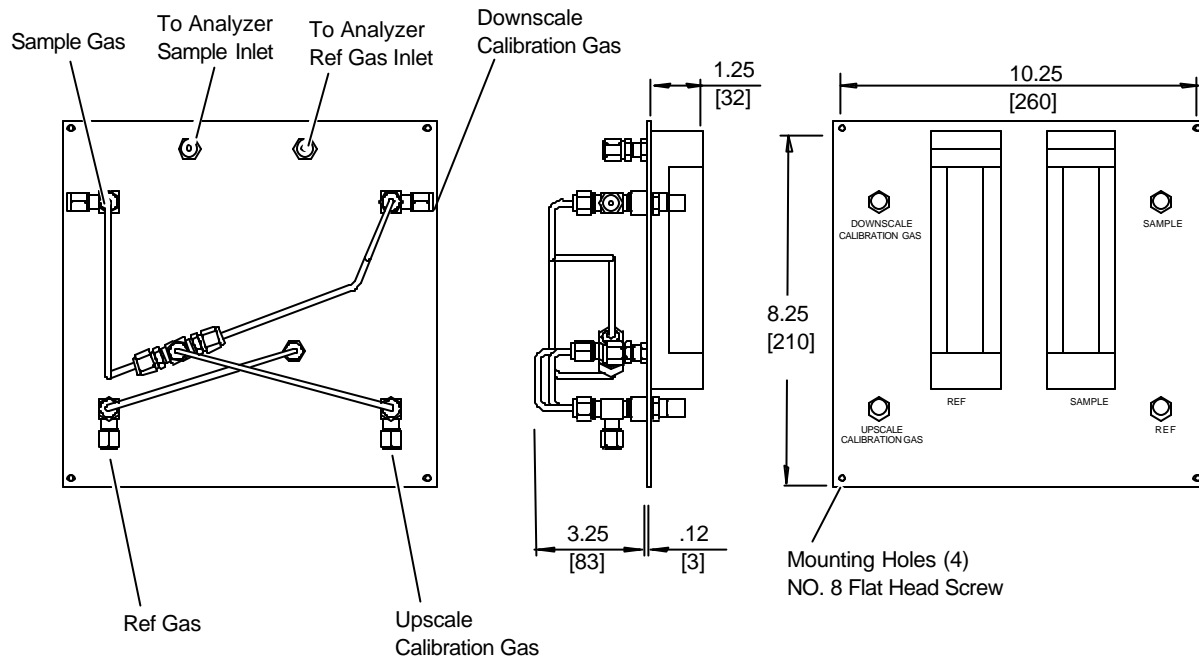


Figure 2-2. Gas Selector Panel for Thermal Conductivity Cell Using Flowing Reference Gas

2-4 LEAK CHECK

Pressurize the system with air or inert gas such as nitrogen, making sure not to exceed specified pressure limitation.

Liberal cover all fittings, seals and other possible sources of leakage with leak test liquid such as SNOOP (PN 837801).

Bubbling or foaming indicates leakage, which MUST be corrected before introduction of flammable-sample and/or application of electrical power.

2-5 GAS CONNECTIONS

The analyzer and gas selector panel modules must be interconnected according to the flow diagram specified in the Data Sheet at the rear of this manual. Gas fittings on both modules are tagged as to use. Fittings are 1/4-inch NPT for 1/4-inch (6.3 mm) tubing. For interconnection, use 1/4-inch (6.3 mm) copper or stainless steel tubing, depending on whether the sample stream is corrosive.

Refer to Figure 2-3 on page 2-4, or Figure 2-4 on page 2-5 and drawing 654625. Connect sample/calibration gas lines to fittings tagged "INLET" on bottom of analyzer. Connect appropriate vent line to fitting labeled "OUTLET."

Follow similar procedure for reference gas, if any.

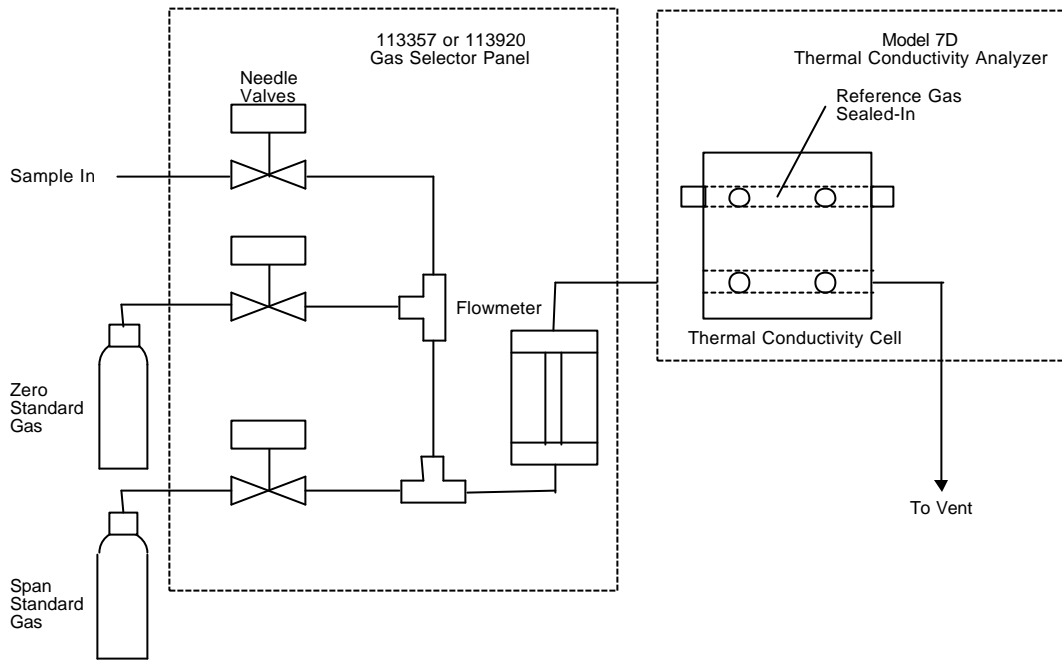
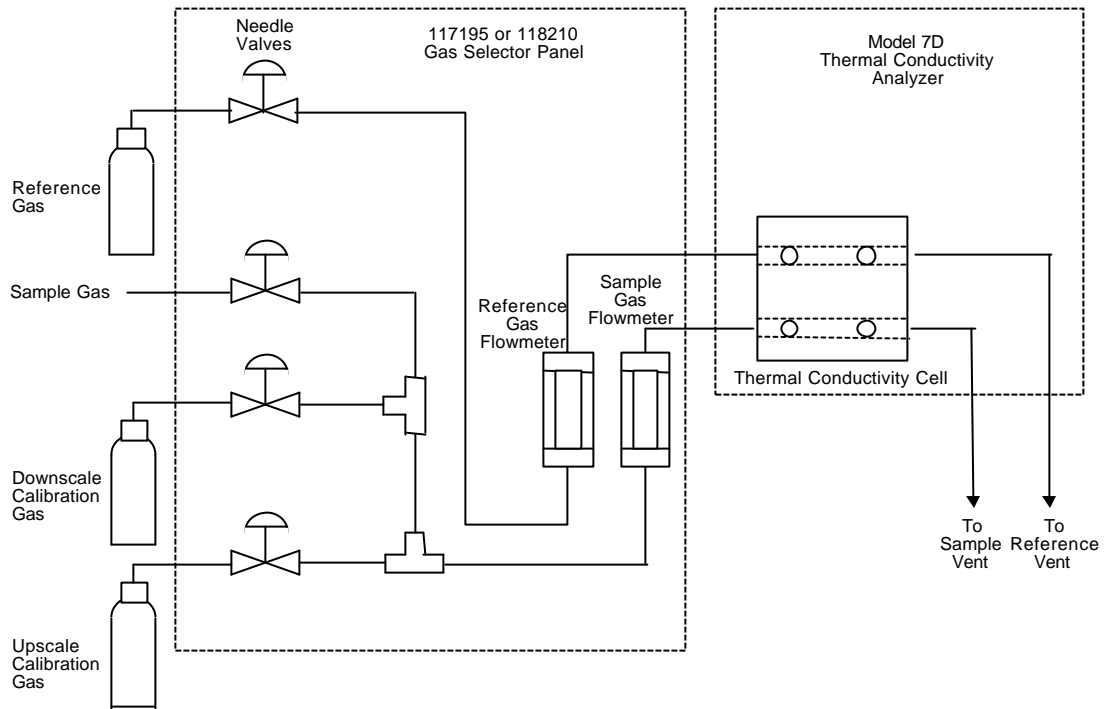


Figure 2-3. Connection of Analyzer Using Sealed-In Reference Gas to Associated Gas

A. DIFFERENT REFERENCE GAS AND CALIBRATION GAS



B. REFERENCE GAS ALSO USED AS CALIBRATION GAS

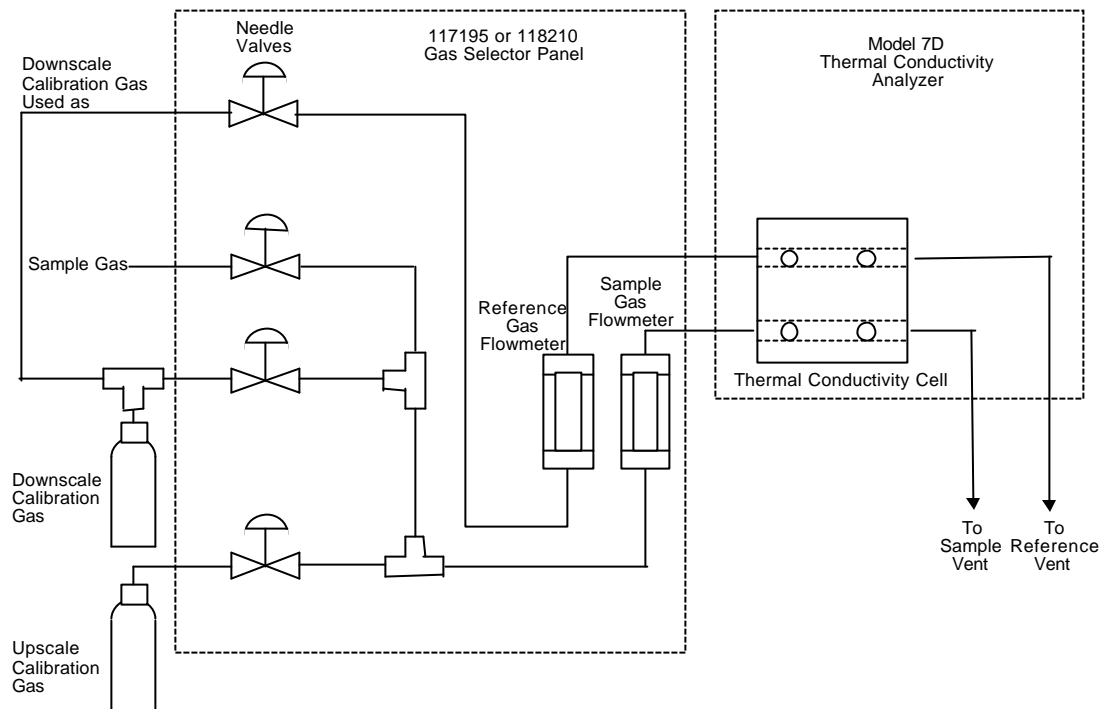


Figure 2-4. Connection of Analyzer Using Flowing Reference Gas to Associated Gas Selector Panel

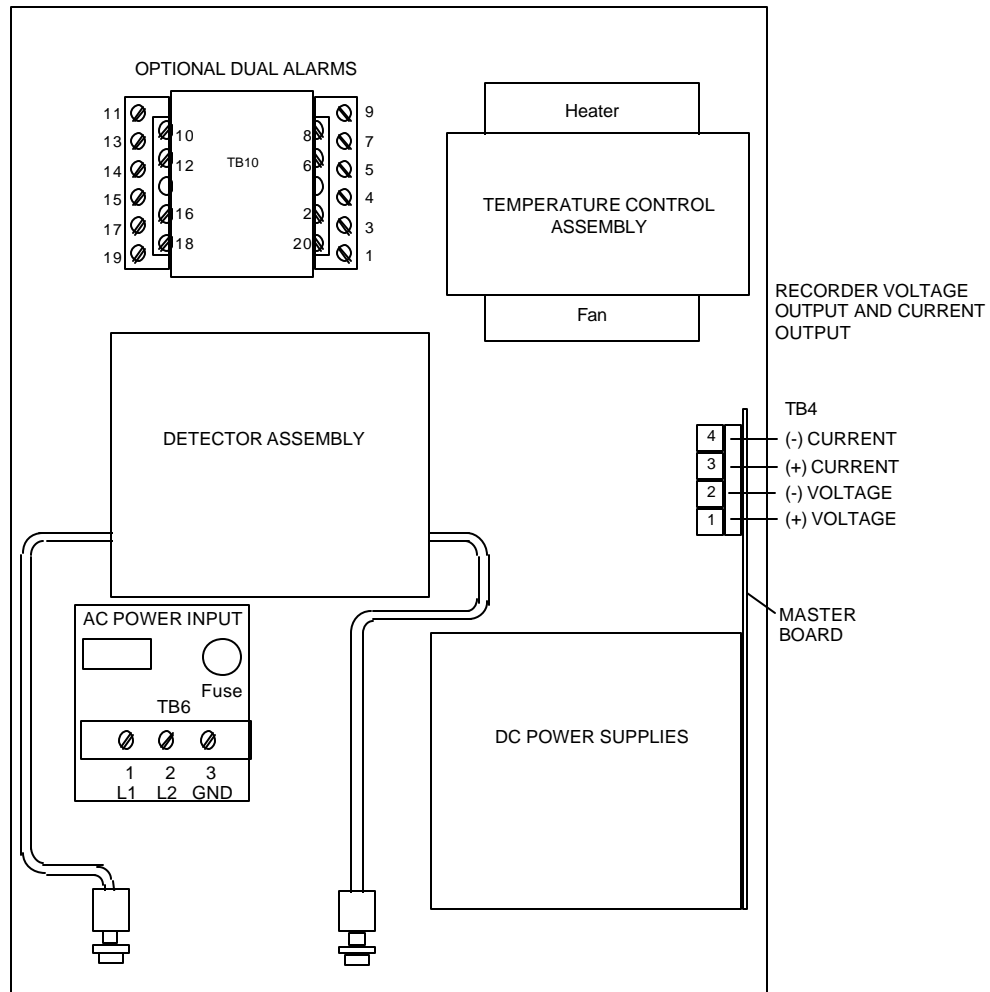


Figure 2-5. Electrical Connections

Model 7D

CAUTION

Do not plug or restrict vents.

2-6 RECORDER OUTPUT SELECTION AND CABLE CONNECTIONS

If a recorder, controller, or other output device is used, connect it to the analyzer (refer to drawing 654642) via a number 22 or number 24 AWG two-conductor shielded cable. Route the cable through conduit to the analyzer, and into the case through the appropriate opening shown in drawing 654625.

NOTE

Route recorder cable through a separate conduit, not with power cable.

Output selection and cable connections for voltage-actuated and current-actuated devices are explained in Sections 2-6a below through 2-6e on page 2-10.

a. Standard (Non-linearized) Voltage Output

1. On the Master Board (Figure 2-6 on page 2-8):
 - a. Verify that TB2-1 is jumpered to TB2-2.
 - b. Set S1 for desired voltage: 5V, 1V, .1V, or .01V.
 - c. Connect the recorder cable to the TB4 terminals labeled VOLT OUT: TB4-1(+) and TB4-2(-).

NOTE

Take the usual precautions to avoid AC pickup. DO NOT GROUND EITHER LEAD.

2. Connect the cable to input terminals of the recorder; ensure that polarity is correct.
3. Ground shield on one end only.

b. Linearized Voltage Output (Optional)

1. Verify that Voltage-Output Linearizer Board (PN 633756) is properly inserted in J102.
2. On the Master Board (Figure 2-6 on page 2-8):
 - a. Verify that TB2-1 is jumpered to TB2-4, and TB2-2 is jumped to TB2-5.
 - b. Set S1 for desired voltage: 5V, 1V, .1 V, or .01 V.
 - c. Connect the recorder cable to the TB4 terminals labeled VOLT OUT: TB4-1 (+) and TB4-2 (-).

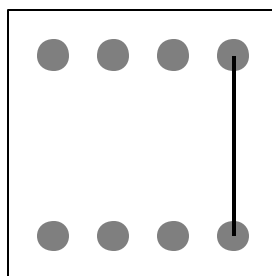
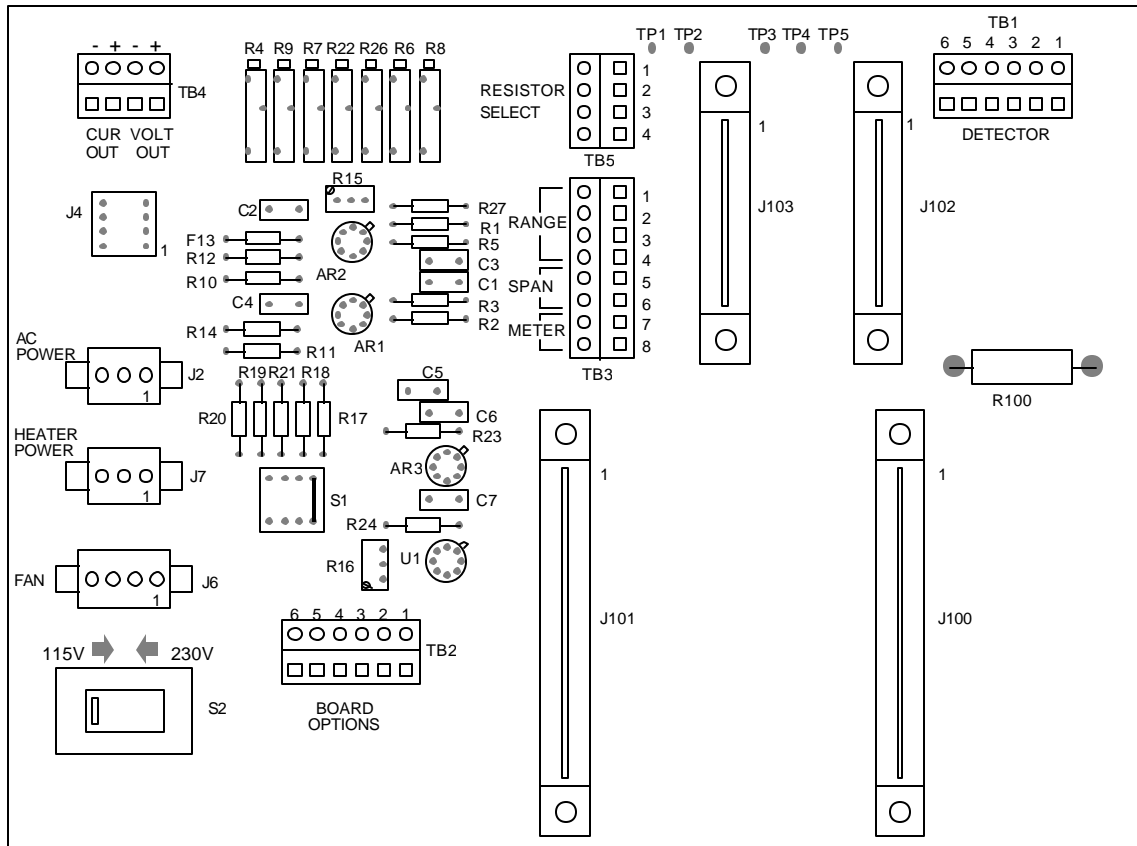
NOTE

Take the usual precautions to avoid AC pickup. DO NOT GROUND EITHER LEAD.

3. Connect the cable to the recorder input terminals; ensure that polarity is correct.

c. Isolated 4 to 20 mA Current Output (Optional)

1. Verify that the Isolated 4 to 20 mA Current Output Board (PN 652816) is properly inserted in J103.
2. On the Master Board (Figure 2-6 on page 2-8):
 - a. Verify that TB2-1 is jumpered to TB2-2 and TB2-2 is jumpered to TB2-6.
 - b. Connect the recorder cable to the TB4 terminals labeled CUR OUT: TB4-3 (+) and TB4-4 (-).
3. Connect the cable to the recorder input terminals; ensure that polarity is correct. Total resistance of the output device and associated cable must not exceed 1500 ohms.



.01V .1V 1V 5V

DETAIL OF S1

S1	Used to select voltage output range: 5V, 1V, 0.1V, or .01V
R4	AR1 gain adjust. Permits adjustment of AR1 gain from X1 to X100, to establish the sensitivity desired for Range 1. This is the highest sensitivity range.
R6, R8, R26	AR1 zero adjust. Used to eliminate voltage offset within AR1 and Bridge, and provide zero suppression.
R9	Setting determines attenuation factor applicable to AR2 output, Range 3.
R7	Setting determines attenuation factor applicable to AR2 output Range 2.
R22	Permits adjusting meter fullscale to agree with recorder full-scale
R15	Used to eliminate voltage offset within AR2.
R16	Sets the stable ± 10 V source.

ADJUSTMENTS

Figure 2-6. Master Board

d. Dual Alarms (Optional)

The alarm module is installed in the instrument as shown in Figure 1-2 on page 1-3 and electrical connections are shown in drawing 654642. The analyzer is factory configured and requires no user adjustments.

Pins for AC power (1, 2, and 3), alarm setpoint control (8, 10, 18, and 19), and signal from analyzer circuitry (7 and 9) are wired at the factory. Connections of the remaining pins depend on individual application requirements.

If the instrument has this option, the analyzer will have the following setpoint adjustment potentiometers: Alarm 1 (the Low Alarm) and Alarm 2 (the High Alarm) on the front panel

(Figure 1-1 on page 1-2) and Deadband on the alarm module (see Figure 2-7 below).

The power and input signals have been wired to the terminal strip into which the alarm module plugs. The wiring to the contacts (18 or 20 AWG) is routed through a conduit hole (see Drawing 654625).

The alarm relay is in energized mode when power is applied. Wire output to the appropriate contact (see Figure 2-5 on page 2-6 and Table 2-1 below). The Form C relay contacts are rated at 5 A, 120 VDC and 1 A, 120 VAC, resistive loads.

A lit LED next to the Deadband pots indicates the alarm is activated.

FRONT VIEW OF ALARM MODULE

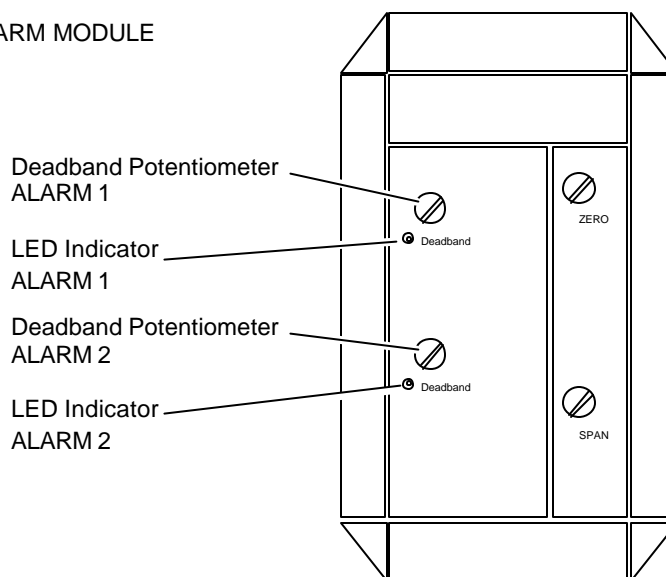


Figure 2-7. Alarm Adjustments

PIN	OUTPUT	PIN	OUTPUT
11	N.C. #1	14	N.O. #2
12	COM #1	15	COM #2
13	N.O. #1	16	N.C. #2

Contact Rating: 1.0 A, 120 VAC; 5.0 A, 120 VAC. Form C, resistive loads.

Table 2-1. Alarm Output Connections

NOTE:

The Zero and Span for setting the input voltage from the analyzer has been set at the factory. To check it, see Section 5-2e on page 5-3.

The following is recommended:

1. A fuse should be inserted into the line between the customer-supplied power supply and the alarm module terminals on the Alarm Relay Assembly.
2. If the alarm contacts are connected to any device that produces radio frequency interference (RFI), the device should be arc-suppressed (P/N 858728 Arc Suppressor is recommended).
3. The analyzer and any RFI-producing device should operate on different AC power sources to avoid RFI.

Removal of AC power from the analyzer, as in a power failure, de-energizes both alarm module relays, setting an alarm condition. Switching characteristics of the ALARM 1 and ALARM 2 relays are as follows:

Alarm 1 Relay

The ALARM 1 relay coil is de-energized when the meter needle moves downscale through the value that corresponds to setpoint minus deadband. This relay coil is energized when the needle moves upscale through the value that corresponds to setpoint plus deadband (see Figure 2-8 on page 2-11).

Alarm 2 Relay

The ALARM 2 relay coil is de-energized when the meter needle moves upscale through the value that corresponds to the setpoint plus deadband. This relay coil is energized when the needle moves downscale through the value that

corresponds to setpoint minus deadband (see Figure 2-8 on page 2-11).

Fail-safe Applications

By making the appropriate connections to the double-throw relay contacts, the operator can obtain either 1) a contact closure or contact opening for an energized relay, or 2) a contact closure or contact opening for a de-energized relay. For fail-safe applications, the operator must understand which circuit conditions are required to achieve relay de-energization in the event of power failure.

e. Linearized Voltage, Two Ranges (Optional)

1. Verify that the Voltage Output Linearizer Board (PN 633756) is properly inserted in both J102 and J103.
2. Verify that the range switch on the door is properly connected: Position (Range) 1 to TB2-5, Position 2 to TB2-3, Wiper to TB2-2.
3. On the Master Board (Figure 2-6 on page 2-8):
 - a. Verify that TB2-1 is jumpered to TB2-4, and TB2-4 is jumpered to TB2-6.
 - b. Select desired range on S1.
 - c. Connect recorder cable to the TB4 terminals labeled VOLT OUT: TB4-1 (+) and TB4-2 (-).

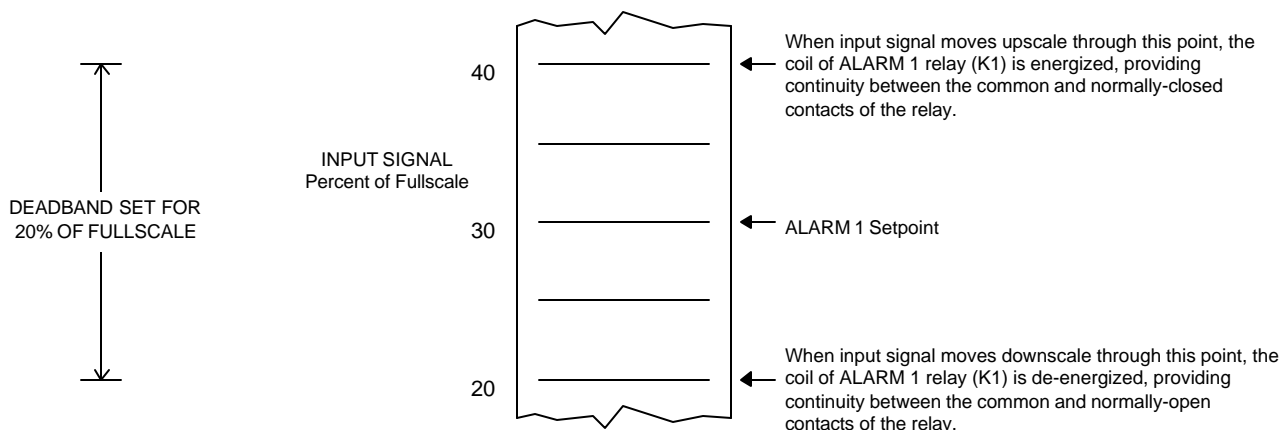
NOTE

Take the usual precautions to avoid AC pickup. DO NOT GROUND EITHER LEAD.

4. Connect the cable to the recorder input terminals; ensure that polarity is correct.

Model 7D

A. Typical ALARM 1 Setting (LOW)



B. Typical ALARM 2 Setting (HIGH)

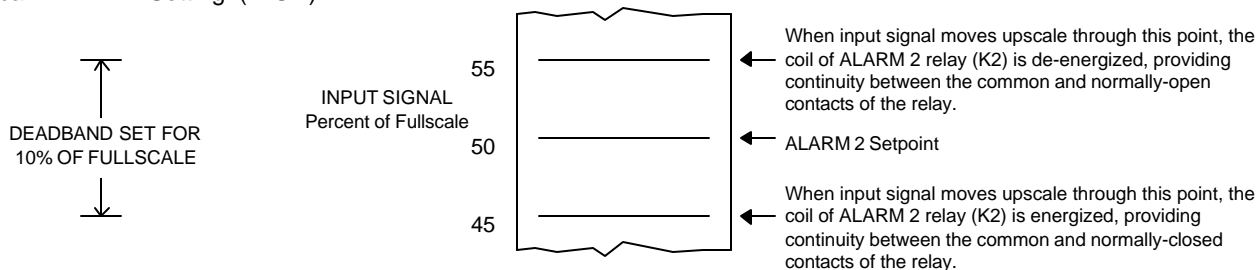


Figure 2-8. Typical Alarm Settings

f. Linearized Voltage and Isolated 4 to 20 mA Current Output (Optional)

1. Verify that the Voltage Output Linearizer Board (PN 633756) is properly inserted in J102.
2. Verify that the Isolated 4 to 20 mA Current Output Board (PN 652816) is properly inserted in J103.
3. On the Master Board (Figure 2-6 on page 2-8):
 - a. Verify that TB2-1 is jumped to TB2-4, TB2-2 is jumped to TB2-5, and TB2-5 is jumped to TB2-6.
 - b. Set S1 for the desired voltage: 5 V, 1 V, .1 V, or .01 V.

- c. Connect the recorder cable to the TB4 terminals labeled VOLT OUT: TB4-1 (+) and TB4-2 (-).

NOTE

Take the usual precautions to avoid AC pickup. DO NOT GROUND EITHER LEAD.

4. Connect the cable to recorder VOLTAGE input terminals; ensure that polarity is correct.
5. On the Master Board (Figure 2-6 on page 2-8):
 - a. Connect the recorder cable to the TB4 terminals labeled CUR OUT: TB4-3 (+) and TB4-4 (-).
 - b. Connect the cable to the recorder CURRENT input terminals; ensure that polarity is correct.

2-7 ELECTRICAL POWER CONNECTIONS

WARNING
ELECTRICAL SHOCK HAZARD
For safety and proper performance, this instrument must be connected to a properly grounded three-wire source of power.
Before supplying electrical power to analyzer, disconnect the red lead from the bridge to TB1-1 or TB1-2 (depending on bridge polarity). This action disconnects power to the bridge (see drawing 654642). To safeguard against filament damage, this lead should remain disconnected until proper gas flow has been established.

The analyzer is supplied, as ordered, for operation on 107 to 127 or 214 to 254 VAC, 50/60 Hz, 250 watts. Verify that the power source conforms to the requirements of the individual instrument as noted on the name rating plate. Ensure that switches S2 on the Master Board (Figure 2-6 on page 2-8) and S3 on the case heater temperature control board (see Figure 2-9 below) are set to required voltage.

Electrical power is supplied to the analyzer via a customer-supplied three-conductor cable, type SJT, minimum wire size 18 AWG. Route the power cable through conduit and into the appropriate opening in the instrument case (see drawing 654625). On TB6, Figure 2-5 on page 2-6, connect cable leads to terminals 1 (HOT/L1), 2 (NEUT/L2), and 3 (GND).

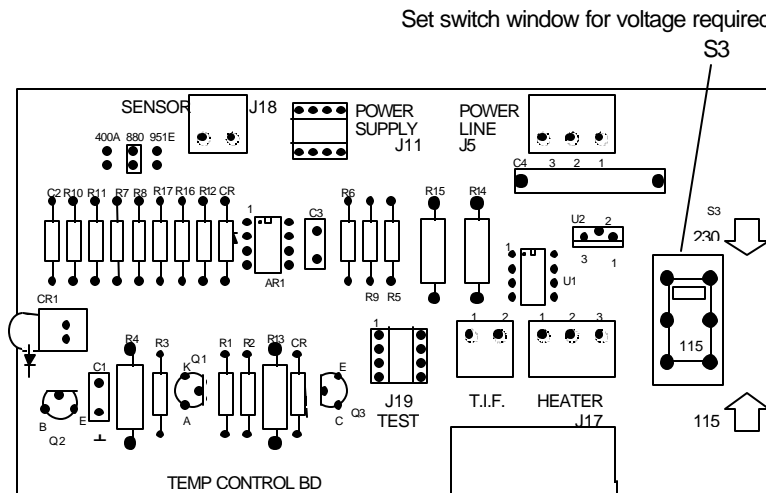


Figure 2-9. Case Heater Temperature Control Board

SECTION 3 STARTUP AND OPERATION

3-1 ANALYZER CONTROLS AND ADJUSTMENTS

Normal operation of the analyzer involves adjustments of only the front-panel controls: ZERO and SPAN, and RANGE Switch, if provided. See Figure 1-1 on page 1-2.

The various internal adjustments are factory set and normally do not require readjustment except after replacement of a circuit board or major component. Refer to Section 5, Service and Maintenance

3-2 GAS SELECTOR PANEL CONTROLS

The controls provided on the optional gas selector panel will depend on the application. For use of sealed-in reference gas, refer to Figure 2-1 on page 2-2 and Figure 2-3 on page 2-4. For flowing reference gas, refer to Figure 2-2 on page 2-3 and Figure 2-4 on page 2-5.

3-3 STARTUP PROCEDURE

WARNING
POSSIBLE EXPLOSION HAZARD
If explosive gases are introduced into this analyzer, the sample containment system must be carefully leak-checked upon installation and before initial startup, during routine maintenance and any time the integrity of the sample containment system is broken, to ensure the system is in leak-proof condition. Leak-check instructions are provided in Section 2-4 on page 2-3.
Internal leaks resulting from failure to observe these precautions could result in an explosion causing death, personal injury or property damage.

WARNING
FILAMENT DAMAGE
Never apply power to analyzer without gas flowing. The filaments in the cell tend to deteriorate faster than normal.

NOTE:

Before supplying electrical power to the analyzer, disconnect the red lead from the bridge to TB1-1 or TB1-2 on the Master Board (depending on detector bridge polarity). This action disconnects power to the bridge. To safeguard against filament damage, this lead should remain disconnected until proper gas flow has been established. Refer to drawing 654642.

After performing a leak check, start up the analyzer as follows:

1. Remove the connector from J2 on the Master Board (Figure 2-6 on page 2-8). Verify that this line goes to TB6, located at the lower left of the instrument (see Figure 1-2 on page 1-3). If it does not, make corrections using drawing 654642 as a reference.
2. Set regulators on the gas cylinders for a supply pressure of 10 to 50 psig (69 to 345 kPa).
3. Provide a sample flow of 50 to 350 cc/minute through the analyzer. A rate of 250 cc/minute is recommended unless faster flow is desired to reduce sample transport time.
4. If the thermal conductivity cell uses flowing reference gas, provide a reference flow of 5 to 50 cc/minute.

5. Refer to drawing 654642 and Figure 2-6 on page 2-8. Connect the cable from TB6 to J2 on the Master Board to provide AC power to the Master Board. Reconnect the red lead of TB1 (or TB2) to provide power to the detector. Apply power to the analyzer. The filaments will now begin to heat. Verify proper flow of sample gas and flowing reference gas, if used.
6. Allow the analyzer to warm-up for a minimum of six hours to ensure temperature equilibrium.

NOTE:

If ambient temperature is below 60°F (15.6°C), or if the temperature will go below 60°F (15.6°C) within the next six hours, allow a minimum of 12 hours for the instrument to stabilize.

Startup is now complete; the analyzer is ready for calibration per Section 3-4 below.

3-4 CALIBRATION

1. Set downscale calibration point as follows:
 - a. On the analyzer, set front-panel SPAN control to midscale (five turns). If the analyzer has front-panel RANGE Switch, set it at Range 1, the highest sensitivity range.
 - b. Admit downscale calibration gas to the analyzer at the same flow rate as is used for sample gas. Wait for the reading on the meter or recorder to stabilize.
 - c. On the analyzer, adjust the front panel ZERO control so that the reading on the front panel meter or recorder is appropriate to the downscale calibration gas.
 - d. If a proper reading is unobtainable by adjustment of the ZERO control, refer to Section 5-2b on page 5-2.

2. Set upscale calibration point as follows:
 - a. If the analyzer has a front panel RANGE switch, set it for the desired range.
 - b. Admit upscale calibration gas to the analyzer at the same flow rate as is used for sample gas. Wait for the reading on the meter or recorder to stabilize.
 - c. On the analyzer, adjust the front panel SPAN control so that the reading on the front panel meter or recorder is appropriate to the upscale calibration gas.

If a proper reading is unobtainable by adjustment of the SPAN control, refer to Section 5, Service and Maintenance.

After the downscale and upscale calibration points have been established, the analyzer is ready for routine operation per Section 3-5 below.

If the analyzer has Suppressed-Zero Ranges and does not calibrate properly, refer to Section 5-3 on page 5-3 for Suppressed Zero Adjustment.

3-5 ROUTINE OPERATION

First, complete startup per Section 3. If the analyzer has more than one range, turn front panel RANGE Switch to desired position. Admit sample gas at the previously selected flow rate. The analyzer will continuously indicate the concentration of the measured component in the sample stream.

A calibration curve can be used to convert meter or recorder readings to concentration values. Typical calibration curves are supplied for standard ranges. Calibration curves for special ranges are available as options.

To avoid use of a calibration curve in an application where it would otherwise be required, the analyzer may be equipped with an optional linearizer board. If so, the

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linearizer board is factory set for a given range only, and is not usable on another range. Note that a linearizer is usable only if nonlinearity at midscale does not exceed 20% of fullscale.

3-6 RECOMMENDED CALIBRATION FREQUENCY

Provided that the instrument remains in continuous operation with power on, it is necessary only to calibrate once a week, by the procedure of Section 3-4 on page 3-2.

To restart the analyzer after power turn-off, repeat the startup procedure of Section 3-3 on page 3-1 and calibrate per Section 3-4 on page 3-2.

3-7 SHUTDOWN

Before turning off sample gas, and flowing reference gas, if used, disconnect power from the analyzer. This precaution minimizes the risk of filament damage.

SECTION 4 THEORY

4-1 THERMAL CONDUCTIVITY CELL AND ASSOCIATED BRIDGE ADJUSTMENTS

Within the thermal conductivity cell are four resistive filaments suspended in individual cavities of a metal block (Figure 4-1A on page 4-3) and connected electrically as legs of a Wheatstone bridge (Figure 4-1B on page 4-3). Although physically the cell block is one piece, functionally it may be considered to have two sides as shown:

Sample Side

Two filaments that constitute opposite legs of the bridge are positioned in a passage that receives a continuous flow of the sample gas.

Reference Side

The remaining two filaments are positioned in a passage filled with the reference gas. Depending on the application, the reference gas may flow continuously through the passage, or it may be sealed within the cell.

The Bridge Voltage Power Supply (PN 613560) is connected, via a 20-ohm dropping resistor, to the bridge (See Section 4-2d on page 4-4). The power supply output is adjusted to provide an appropriate voltage across bridge terminals 1(+) and 2(-). An electric current flows through the filaments, heating them and thus increasing their electrical resistance. The heat-dissipation rate for each filament depends on the thermal conductivity of the surrounding gas. Initially, with downscale calibration gas flowing through the sample and reference sides of the flow-through configuration, R26 is set for zero bridge-output signal. During subsequent analysis of the sample stream, any change in the relative proportions of the components passing through the sample side changes the thermal conductivity of the gas mixture, causing a temperature differential between sample and reference filaments. The

resultant change in filament resistance unbalances the bridge.

The bridge-imbalance signal is routed to the Master Board (PN 654620), where it is processed to drive the front-panel meter and recording device, if used (see Section 4-2a below).

Periodically, downscale calibration gas is passed through the cell, and the front panel ZERO Pot is adjusted for an appropriate reading on the meter or recorder.

4-2 ELECTRONIC CIRCUITRY

Electronic circuitry of the Model 7D is shown in the schematic diagram of drawing 654616. Internal circuitry of plug-in boards and other electronic assemblies is shown in separate schematic diagrams, found at the end of this manual, and is described in the following sections.

a. Master Board

The Master Board (PN 654620), Figure 2-6 on page 2-8, provides two stages of amplification utilizing integrated-circuit amplifiers AR1 and AR2.

Functions Associated with AR1

AR1

Gain Adjust Potentiometer R4. This screwdriver-adjustable, factory-set trimming potentiometer determines feedback resistance for AR1 and thus permits adjustment of AR1 gain from X1 to X100. This adjustment sets the sensitivity for Range 1, i.e., the highest-sensitivity range.

Range Provisions

In the basic single-range Model 7D, a jumper is connected from TB3-1 to TB3-4, thus routing the unattenuated output from AR1 directly to the non-inverting input of

AR2. During factory assembly of a dual-range or triple-range instrument, the jumper is omitted and a front panel RANGE Switch is connected as shown below. The output from AR1 is then routed to AR2 through a network that provides adjustable attenuation for ranges 2 and 3.

RANGE	AR1 OUTPUT ATTENUATION	RANGE SWITCH POSITION	TB3 POSITION
1	X1, fixed	1	1
2	adjustable by R7	2	2
3	adjustable by R9	3	3
		wiper	4

Table 4-1. Range Switch Connections

Coarse zero and zero-suppression

Pots R26, R6 or R8, depending upon range number, provide the zero correction at the non-inverting input of AR1.

Functions Associated with AR2

AR2 Zero Adjustment Potentiometer R1

This screwdriver-adjustable, factory-set trimming potentiometer is used to eliminate voltage offset within AR2. When the input signal is zero, R15 is adjusted so that the output signal also is zero.

Front-Panel SPAN Control

This potentiometer, connected across TB3-5 and TB3-6, provides continuously variable adjustment of closed-loop gain for AR2, to permit establishing an upscale calibration point on the meter scale or recorder chart. With upscale calibration gas flowing through the analyzer, the SPAN Control is adjusted for the appropriate reading.

Front-Panel Meter

The meter is connected from TB3-7 to TB3-8. Potentiometer R22 permits adjusting meter sensitivity so that meter fullscale agrees with recorder fullscale.

Output Selection Switch S1

The desired output is obtained by appropriate selection of switch contacts: 5V, 1V, .1V, or .01V.

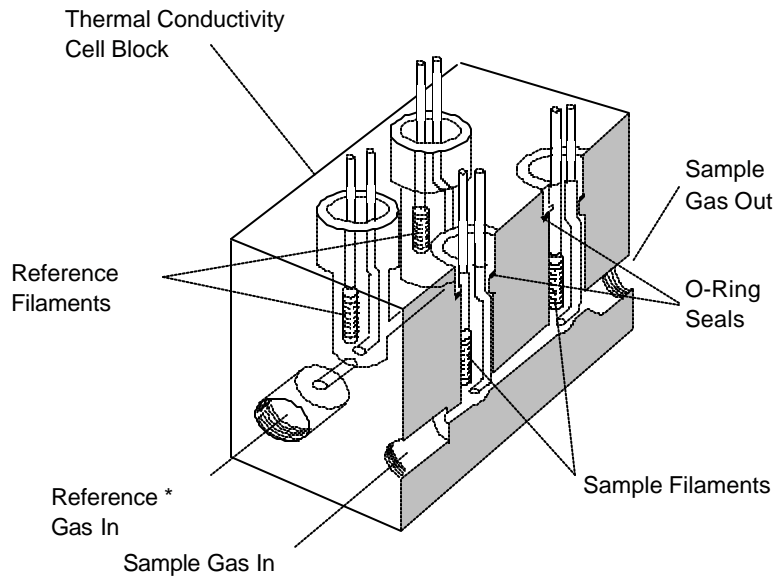
b. Voltage Output Linearizer Board (Optional)

The output signal from the Master Board is a function of the degree of imbalance in the bridge circuit, but is not linear with respect to the concentration of the measured component. Providing that the nonlinearity of the calibration curve does not exceed 20% at midscale (for 50 % H₂ max.), the Voltage Output Linearizer Board (PN 633756) may be used to equip a given operating range for linear readout of concentration on the meter and on a potentiometric recorder.

Straightening of the concentration vs output curve is accomplished by sequential adjustment of eight odd numbered trimming potentiometers designated R19 through R33. Each pot controls the gain of an associated operational amplifier.

During factory checkout of a linearizer circuit board, potentiometers R19 through R33 are initially set at midrange. With zero input signal applied to the linearizer circuit, ZERO potentiometer R35 is adjusted for zero output. Then an appropriate low-level signal is applied to the input, and R19 is adjusted for fullscale output. The procedure is repeated as many times as required to obtain properly linearized output.

A. SECTIONAL VIEW OF THERMAL CONDUCTIVITY CELL



* Reference Ports Capped if Cell Uses Sealed-In, Non-Flowing Reference Gas.

NOTE: Cell Block Sectioned Through Sample Side. Section Through Reference side is Similar.

B. FUNCTIONAL DIAGRAM OF BRIDGE CIRCUIT

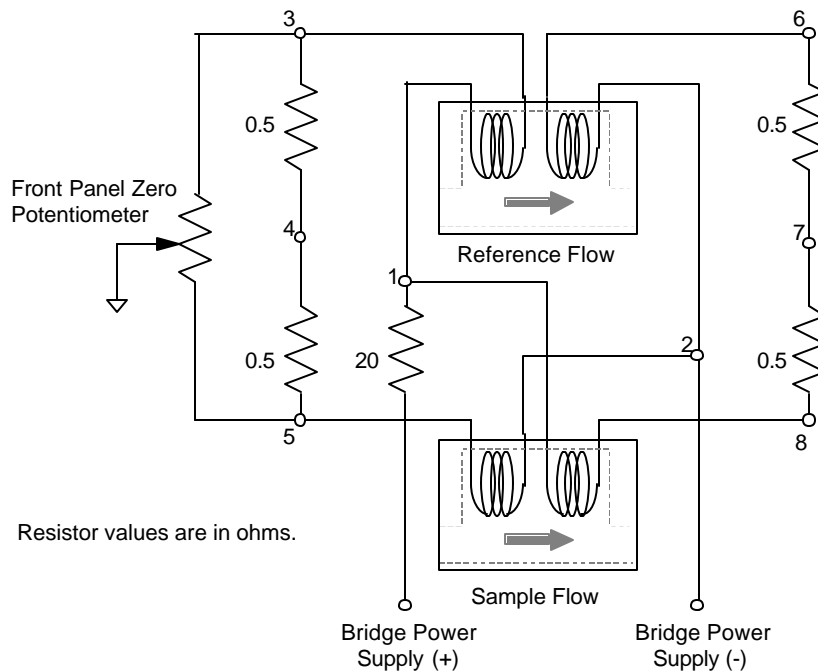


Figure 4-1. Thermal Conductivity Cell

c. Isolated 4 to 20 mA Current Output Board (Optional)

This option provides isolated current output for applications which require 4 to 20 mA into a maximum load of 1500 ohms. This output is *NOT* linearized. A description of the board and the functions of its main components follows. Refer to schematic 652813 at the rear of this manual.

The purpose of the Isolated Current Output Board (PN 625816) is to convert an input signal of 0 to -5 V to an isolated output signal of 4 to 20 mA. With a zero voltage at the input, R6 is adjusted so that the output at AR1 is 1 V. The gain of AR1 is .8 so that an input of 0 to -5 V is converted to 1 to 5 V. This voltage is fed to a variable output level-inverter consisting of AR2, Q1, Q2, and T1. T1 has two identical output windings, each with a rectified DC output. One is used to provide feedback to the inverter input of AR2. The other is used as an isolated output to drive AR3 and Q3 with a 1 to 5 V signal across R16. Trim-pot R17 is adjusted to provide a span of 4 to 20 mA. This current is presented to the collector of Q3 and is capable of driving loads of up to 1500 ohms.

d. Bridge Power Supply

The regulated, adjustable voltage required for the thermal conductivity bridge (Section 4-1 on page 4-1) is provided by the Bridge Power Supply (PN 613560). It consists of a power transformer, fullwave rectifiers CR1 and CR2, voltage regulator Q1, and an RC filter network. Bridge voltage, as measured between bridge terminals 1(+) and 2(-), is adjustable from 5 to 13 VDC via R2. Proper setting depends primarily on filament material: 3 to 4 VDC for tungsten; 5 to 12 VDC for Hitempco. Bridge voltage is factory-set as required for the application (see Data Sheet in the rear of this manual) and normally does not require readjustment unless the power supply is replaced.

e. ±15 Volt Power Supply

The ±15 Volt Power Supply (PN 619714) plugged into J101 of the Master Board, provides power for the various circuits. As shown in drawing 619710, power transformer T1 has three secondary that are used as follows:

38 VAC center-tapped secondary

Powers both 15 volt supplies through diode bridge CR1 and filter capacitors C1 and C4.

The adjustable positive regulator, VR1, is set by voltage divider R1, R2 and R3 and its output is applied to pin A of the circuit board and to test point TP1.

Potentiometer R2 should be adjusted to +15.5 VDC ±50 mVDC.

The negative DC, regulated by VR2 is applied to pin D of the circuit board.

The center tap is the common reference for both the +15 and -15 volt supplies and is applied to pin R of the circuit board and to test point TP2.

Both outputs are used for individual amplifiers on the various circuit boards.

90-volt center-tapped secondary

Drives a rectifier circuit on the optional Current Output Board (PN 652816). The transformer winding and the associated circuit constitute a floating power supply for the emitter-follower stage. Refer to Section 4-2c above.

9.5 VAC secondary

Drives a +5 VDC supply not used in this instrument.

f. Detector Blocks

There are two types of detector configurations; flowing reference and sealed nitrogen reference. The sealed reference with nitrogen can be recharged by flowing nitrogen through the reference

Model 7D

and closing the plugs. Three filament types are available: tungsten, Hitempco, and gold-sheathed tungsten.

g. Case Temperature Controller Assembly

The case Temperature Controller Assembly (PN 652270) maintains an approximate 117°F (47°C) temperature within the instrument.

Changes in case temperature affect the resistance of the sensor connected to J18. This in turn changes the bias of amplifier AR1, which controls the input to the case heater via switch U2. The heater receives power through pins 3, 4 and/or 5, depending on the voltage selected at switch S3. A thermal fuse at J5 prevents the case from overheating.

h. Dual Alarms (Option)

Instruments with optional Dual Alarms have two pots on the front door which are

used to select setpoints. The scales on the nameplate designate setpoints from 0 to 100%.

The alarm module is shown in Figure 6-2 on page 6-5, and the factory connections are shown in drawing 654642. The module plugs into a socket, which is part of a terminal block mounted onto the chassis of the instrument. A marker on the alarm module indicates the function of each socket pin.

This unit is factory configured and requires no user adjustment. Pins for AC power (1, 2, and 3), alarm setpoint control (8, 10, 18, and 19), and signal from analyzer circuitry (7 and 9) are wired at the factory.

Connections of the remaining pins depend upon the application. The relays are rated at 1.0 A, 120 VAC and 5.0 A, 120 VDC, form C, resistive loads.

SECTION 5 SERVICE AND MAINTENANCE

WARNING

POSSIBLE EXPLOSION HAZARD

If explosive gases are introduced into this analyzer, the sample containment system must be carefully leak-checked upon installation and before initial startup, during routine maintenance and any time the integrity of the sample containment system is broken, to ensure the system is in leak-proof condition. Leak-check instructions are provided in Section 2-4 on page 2-3.

Internal leaks resulting from failure to observe these precautions could result in an explosion causing death, personal injury or property damage.

In troubleshooting, the basic approach is to isolate the analyzer from the sample and the sample-handling system.

First admit downscale and upscale standard gases to analyzer and note response:

1. If performance is normal with standard gases, although not with sample gas, the sample and the sample-handling system are suspect. Check these areas.
2. If analyzer gives offscale or erratic readings with standard gases, as well as with sample gas, the problem might be the filaments or the electronic circuitry. To isolate the malfunction, substitute fixed precision resistors of appropriate value for the filaments. Hitempco filaments (P/N 25499) have a cold resistance of 72 ohms. Tungsten filaments (P/N 811993) have a cold resistance of 18 ohms. Filament connections are shown in drawing 654616. With appropriate resistors substituted for the filaments, attempt to balance the bridge as follows:

- a. If bridge balance is obtained with the fixed resistors, the filaments are probably defective and should be replaced.
- b. If bridge balance is unobtainable with the fixed resistors, the problem might be the electronic circuitry. Substitute each circuit board, in turn, until proper operation is obtained.

5-1 THERMAL CONDUCTIVITY CELL

The thermal conductivity cell and associated elements of the bridge are mounted inside the analyzer case, within a thermally-insulated compartment.

Depending on the bridge current level, the filaments gradually become mismatched, and eventually burn out. Normal progression of symptoms is baseline drift. Sealed reference cells must be serviced by the factory.

If the cell uses flowing reference gas, the filaments may be replaced by the user. Refer to Figure 4-1 on page 4-3 and the parts list in Section 6.

Filaments are sold as matched sets. If one must be replaced, its mate also must be replaced. Electrically, the filaments are mated across the diagonals of the cell. Refer to Figure 4-1B. The filament across points 3 and 1 corresponds to the filament across 8 and 1, and the filament across points 6 and 2 corresponds to the filament across 5 and 2.

5-2 ELECTRONIC CIRCUITRY

a. Amplifier Zero Adjustments

The zero adjustments on the Master Board are factory set and normally do not require readjustment except after replacement of a major component. If

readjustment becomes necessary, use following procedure:

AR2 Zero Adjustment:

1. Open the input to AR2. In a single-range instrument, this is done by disconnecting the jumper from TB3-1 to TB3-4.
2. Ground the input of AR2 by connecting a jumper from TB3-4 to TP1 (GND).
3. Adjust R15, (Figure 2-6 on page 2-8), for 0 VDC output signal at TB4-2.
4. Restore connections to normal.

b. Bridge Balance and Range Sensitivity Adjustments

Perform start-up procedure in Section 3-3 on page 3-1, then proceed as follows:

1. On the analyzer module, set the front panel ZERO and SPAN potentiometers to their midpoints (five turns). If the analyzer has a front panel RANGE Switch, set it to Range 1, the highest-sensitivity range.
2. Admit downscale calibration gas to the analyzer at the same flow rate as is used for the sample gas. Wait for the reading on the meter or recorder to stabilize.
3. Refer to Figure 2-6 on page 2-8 and set the Balance Adjustment on the Master Board, (range 1 or single range R8, range 2 R6, range 3 R26) so that the reading on the meter or recorder is zero or an offset value. Refer to Data Sheet in the rear of this manual.

Sensitivity Adjustment(s) are:

1. Admit upscale calibration gas to the analyzer at the same flow rate as is used for the sample gas. Wait for reading on meter or recorder to stabilize.

2. On the Master Board, set AR2 Gain Adjustment R4 so that reading on the recorder, if used, or on the front-panel meter is appropriate to the upscale calibration gas. Refer to Data Sheet in the rear of this manual or calibration curve. Range 1 sensitivity is now properly adjusted.
3. If analyzer has more than one range, set the front panel RANGE Switch for Range 2. This is the reduced sensitivity range. Then, on the Master Board, set Range 2 Attenuation Adjustment R7 so that the reading on the recorder, if used, or on the front panel meter is appropriate to the upscale calibration gas.
4. If the analyzer has three ranges, set the front panel RANGE Switch for Range 3. This is the least sensitive range. Then, on the Master Board, set Range 3 Attenuation Adjustment R9 so that the reading on the recorder, if used, or on the front panel meter is appropriate to the upscale calibration gas.
5. If previous readings were obtained on a recorder, set the Meter 100% Adjustment R22 so that the meter fullscale matches the recorder fullscale. If the analyzer has more than one range, this adjustment should be made on Range 1.

c. Bridge Voltage Adjustment

Bridge voltage is factory set as required for the application (see Data Sheet in the rear of this manual) and normally does not require readjustment unless the bridge power supply is replaced. Bridge voltage is measured between terminals 1(-) and 2(+), and is adjustable via R2, DWG 613561, on the bridge power supply.

Model 7D

d. Case Temperature Controller

Refer to Figure 6-3 on page 6-6. Malfunction in this option can occur in three areas:

Heater

Check continuity with ohmmeter. Verify that resistance is approximately 113 ohms at 25°C.

Temperature Sensor

This is an RTD and should have approximately 550 ohms at 25°C. Check for continuity with ohmmeter.

Thermal Fuse

The fuse opens at temperatures above 72°C. Check continuity with ohmmeter.

e. Dual Alarm Module (Optional)

This module is not user-serviceable. If problems occur, contact Rosemount Analytical Customer Service Center (see page 7-1).

The module has Zero and Span potentiometers that set the 0 to 5 V input. To check these, adjust the analyzer for zero gas, set the Low Alarm (ALARM 1 on the front panel) set point to 0 %, and turn the Deadband counterclockwise. Adjust the Zero pot to trigger the alarm. Do the same for High Alarm (ALARM 2 on the front panel). The alarm span should agree with the analyzer meter span. Readjust the deadbands to the desired level. (See Figure 2-7 on page 2-9 and Figure 2-8 on page 2-11.)

5-3 SUPPRESSED ZERO ADJUSTMENT

If the instrument has suppressed-zero ranges and does not calibrate properly, adjust the potentiometers located on the Master Board (see Figure 2-6 on page 2-8). Follow the startup procedure in Section 3-3 on page 3-1. After the analyzer has stabilized, use

appropriate calibration gases to make the following adjustments. Refer to Section 2-3b on page 2-1 for information on selecting appropriate gases.

NOTE

For instruments with more than one range, RANGE 1 is the most sensitive range; it must be set for the highest gain. This range should be used for the smallest span. Always start procedure with RANGE 1 (i.e., RANGE 1 ... 95 to 100%, RANGE 2 ... 90 to 100%, RANGE 3 ... 60 to 80%).

1. Set the front panel ZERO and SPAN pots to their midpoints (five turns).
2. If the instrument has a Range Switch, set it to RANGE 1.
3. Connect a digital voltmeter between TB3-1 and TP1 (polarity does not matter).
4. Flow downscale calibration gas through the sample inlet of the analyzer. Adjust R8 until the reading on the voltmeter is zero. The front panel meter should also read zero.
5. Flow upscale calibration gas through the sample inlet of the instrument. Adjust R4 until the front panel meter reads 100 % (fullscale).
6. Repeat steps 4 and 5 above until no adjustment is required.

If the analyzer has more than one range, repeat steps 2 through 6 with the following alterations:

Range 2

Set the Range Switch to RANGE 2. In step 4, adjust R6, and in step 5, adjust R7.

Range 3

Set the Range Switch to RANGE 3. In step 4, adjust R26, and in step 5, adjust R9.

SECTION 6 REPLACEMENT PARTS

WARNING**PARTS INTEGRITY**

Tampering with or unauthorized substitution of components may adversely affect safety of this product. Use only factory-approved components for repair.

Because of the exchange policy covering circuit boards, the following list does not include individual electronic components. If circumstances necessitate replacement of an individual component, which can be identified by inspection or from the schematic diagrams, obtain the replacement component from a local source of supply.

6-1 CIRCUIT BOARD REPLACEMENT POLICY

In most situations involving a malfunction of a circuit board, it is more practical to replace the board than to attempt isolation and replacement of the individual component, as the cost of test and replacement will exceed the cost of a rebuilt assembly. As standard policy, rebuilt boards are available on an exchange basis.

6-2 REPLACEMENT PARTS

The following parts are recommended for routine maintenance and troubleshooting of the Model 7D. If the troubleshooting procedures do not resolve the problem, contact Rosemount Analytical Customer Service Center (see page 7-1).

Figure 6-1 through Figure 6-3 show locations of components and assemblies.

a. Selected Replacement Parts

- 652270^{1,2} Temperature Control Assembly (Section 6-2b)
- 654648^{1,2} Alarm Kit (Section 6-2c)
- 654892^{1,2} Range Switch Kit (Section 6-2d)
- 613560 Bridge Power Supply (Figure 6-2)
- 619714 ±15V Power Supply (Figure 6-2)
- 654632¹ Detector Assembly w/Filaments - Flowing Ref (Gold Sheathed Tungsten) (Figure 4-1)
- 654630¹ Detector Assembly w/Filaments - Flowing Ref (Hytempco) (Figure 4-1)
- 654628¹ Detector Assembly w/Filaments - Flowing Ref (Tungsten) (Figure 4-1)
- 654627^{1,3} Detector Assembly w/Filaments - Sealed Ref (Tungsten)
- 654631^{1,3} Detector Assembly w/Filaments - Sealed Ref Nitrogen (Gold Sheathed Tungsten)
- 654629^{1,3} Detector Assembly w/Filaments - Sealed Ref Nitrogen (Hytempco)
- 902444¹ Filaments (Gold Sheathed Tungsten) (Figure 4-1)
- 902443¹ Filaments (Hytempco) (Figure 4-1)
- 902442¹ Filaments (Tungsten) (Figure 4-1)
- 638426 Flame Arrestor (Figure 6-1)
- 801566¹ Fuse 1.5A (230VAC) (Figure 6-2)
- 000516¹ Fuse 3A (115VAC) (Figure 6-2)
- 652816¹ Isolated Current Output Board (Figure 6-2)
- 616443¹ Linearizer Kit (Factory Installed option. Consult factory.) (Figure 6-2)
- 654620 Master Board (Figure 6-2)
- 193311 Meter (Figure 6-1)
- 898672 SPAN Potentiometer (Figure 6-1)
- 901917 ZERO Potentiometer (Figure 6-1)

b. Temperature Control Assembly

Refer to Figure 6-3.

- 622733 Fan
- 622732 Heater
- 624006 Temperature Control Board
- 622917 Temperature Sensor
- 624433 Thermal Fuse

c. Alarm Option

Refer to Figure 6-1 and Figure 6-2.

- 901916 Socket, 20 Pin
- 901913 Dual Alarm Module
- 901918 Variable Resistor 1K ohm

d. Range Switch Kit

Refer to Figure 6-1 and Figure 6-2.

- 633899 Switch

¹ Parts are selected or are optional depending on instrument application. Refer to Application Data Sheet and ordering information to determine which parts are applicable to your instrument.

² Refer to section listed for replacement parts of assembly.

³ Sealed reference cells must be serviced at factory.

Model 7D

6-3 MATRIX

Each analyzer is configured per the customer sales order. Below is the Model 7D sales matrix which lists the various configurations available.

To identify the configuration of an analyzer, locate the analyzer name-rating plate. The sales matrix identifier number appears on the analyzer name-rating plate.

7D MODEL 7D TC ANALYZER (EXPLOSION PROOF ENCLOSURE)								
Parameter and Background Gas								
Code		Code						
10	Hydrogen in Air	21	Helium in Nitrogen					
11	Hydrogen in Nitrogen	22	Helium in Oxygen					
12	Hydrogen in Methane	23	Helium in Methane					
13	Hydrogen in Argon	24	Helium in Argon					
14	Hydrogen in Carbon Dioxide	25	Helium in Carbon Dioxide					
20	Helium in Air	26	Helium in Argon & Oxygen					
50	Nitrogen in Hydrogen (0-5000 ppm Range Only) Range Code #31							
60	Refinery (15% Hydrocarbon - 85% N ₂ ; 100% N ₂ ; 1% Hydrogen in 99% N ₂) Range Code #60							
61	Utilities (BD Special) (80-100% H ₂ in Air, 0-100% H ₂ in CO ₂ and 0-100% Air in CO ₂) Range Code #61							
90	Argon in Air							
91	Argon in Nitrogen							
92	Argon in Oxygen							
93	Carbon Dioxide in Air							
94	Carbon Dioxide in Nitrogen							
95	Carbon Dioxide in Oxygen							
96	Nitrogen in Argon							
97	Corrosive Gas Mixture Application (Zero Based Ranges Only) Range Code #97							
98	Corrosive Gas Mixture Application (Suppressed Range Only) Range Code #98							
99	Special							
Code	Range	Linearization			Reference		Filament	
		Not Applicable	Optional	Not Available	Sealed	Flowing	Tungsten	Hytempco
14	85-100%		X			X	X	
15	95-100%	X				X	X	
16	99-100%	X				X		X
17	99.5%-100%	X				X		X
19	Special Suppressed Range							
30	0-500 ppm	X				X		X
31	0-5000 ppm	X				X		X
01	0-1%	X			X		X	
02	0-5%	X			X		X	
03	0-10%		X		X		X	
04	0-15%		X		X		X	
05	0-25%		X		X		X	
06	0-50%		X		X		X	
07	0-75%			X	X		X	
08	0-100%			X	X		X	
09	Special Zero Based Range							
10	20-50%		X		X		X	
11	45-55%		X		X		X	
12	60-80%		X		X		X	
13	50-100%		X		X		X	
60	Refinery	X			X		X	
61	Utilities		X		X		X	
97	Corrosive Gas Mixture - Application Zero Based Range				X			Gold Sheathed
98	Corrosive Gas Mixture - Application Suppressed Range					X		Gold Sheathed
Code	Single & Dual Range Analyzer							
01	One Range, Voltage Output							
02	One Range, Linearized Voltage Output							
03	One Range with 4-20 mA, Isolated Current Output							
04	One Range, Linearized and 4-20 mA, Isolated Current Output							
05	Two Ranges, Voltage Output							
06	Two Ranges, Range One Linearized Voltage Output							
Code	Second Range: Dual Range Analyzer							
XX	Range Selections same as position 5, 6; 00 if second range is not selected.							
Code	Power, Alarm, Tropicalization							
01	115V, 50/60 Hz							
02	115V, 50/60 Hz with Dual Alarm							
03	115V, 50/60 Hz with Tropicalization							
04	115V, 50/60 Hz with Dual Alarm and Tropicalization							
05	230V, 50/60 Hz							
06	230V, 50/60 Hz with Dual Alarm							
07	230V, 50/60 Hz with Tropicalization							
08	230V, 50/60 Hz with Dual Alarm and Tropicalization							
7D	12	03	02	00	03	Example		
1,2	3,4	5,6	7,8	9,10	11,12	Matrix positions		

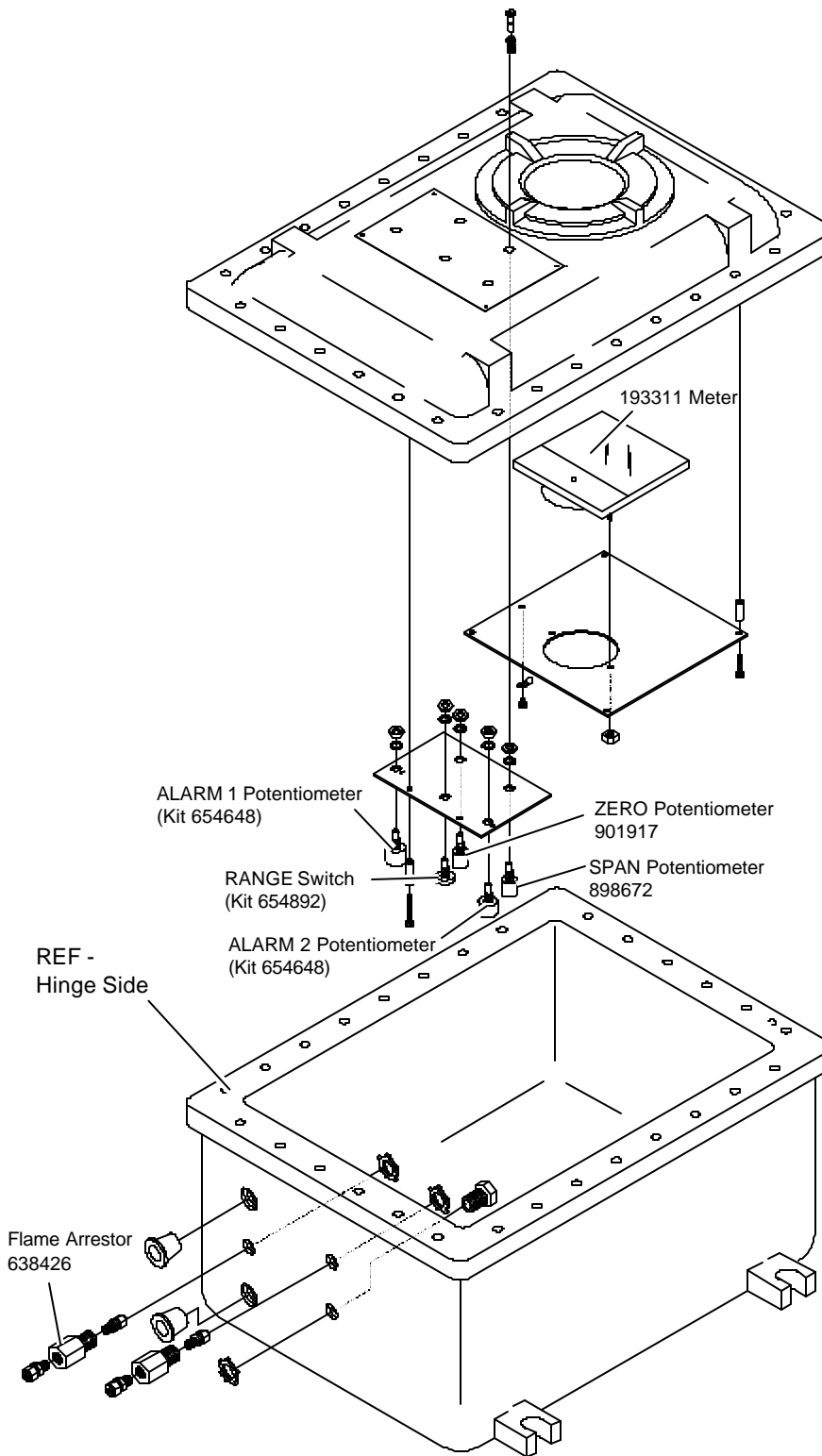


Figure 6-1. Analyzer Assembly - Door and Pneumatic Components

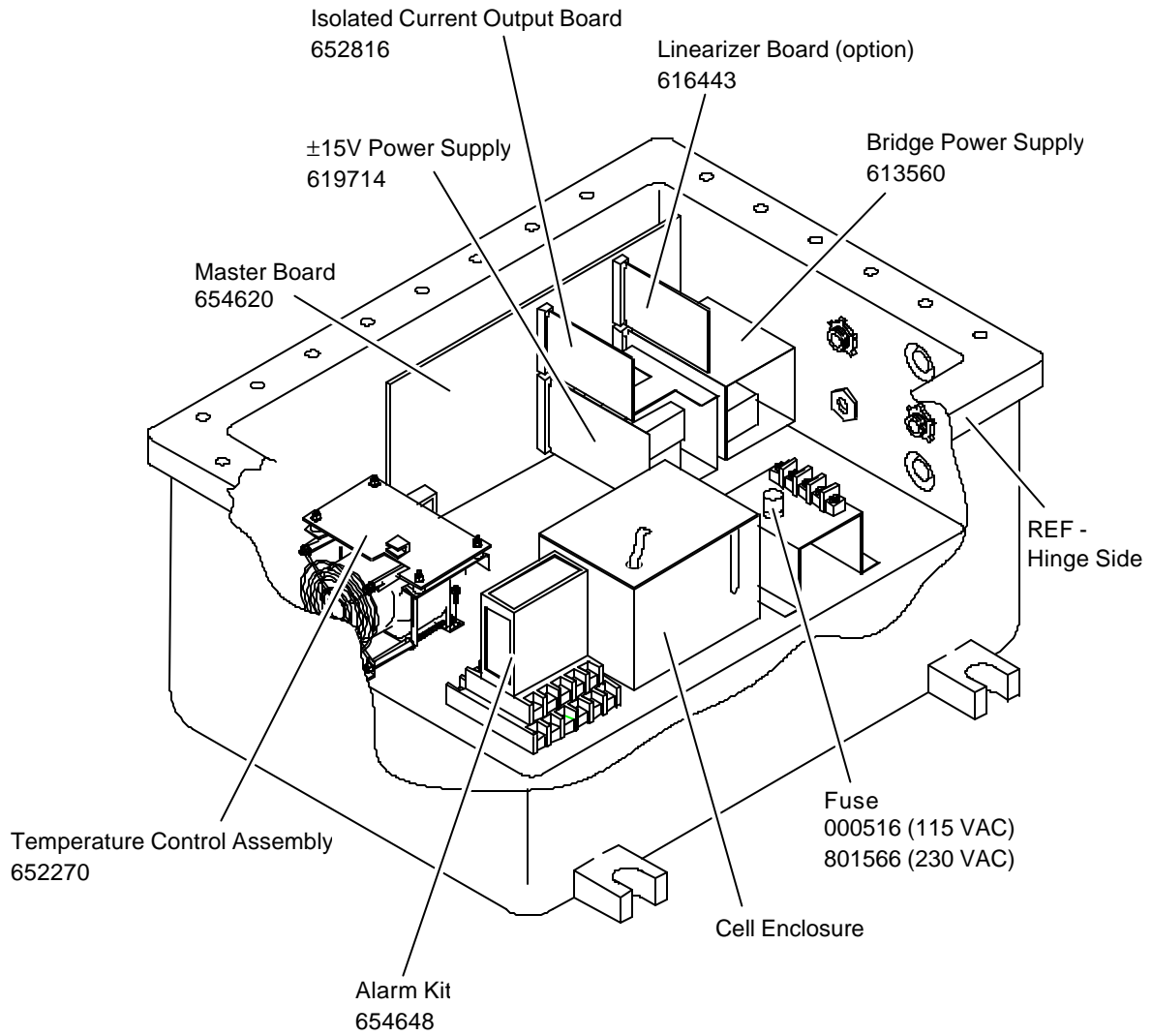


Figure 6-2. Analyzer Assembly - Electronic Components

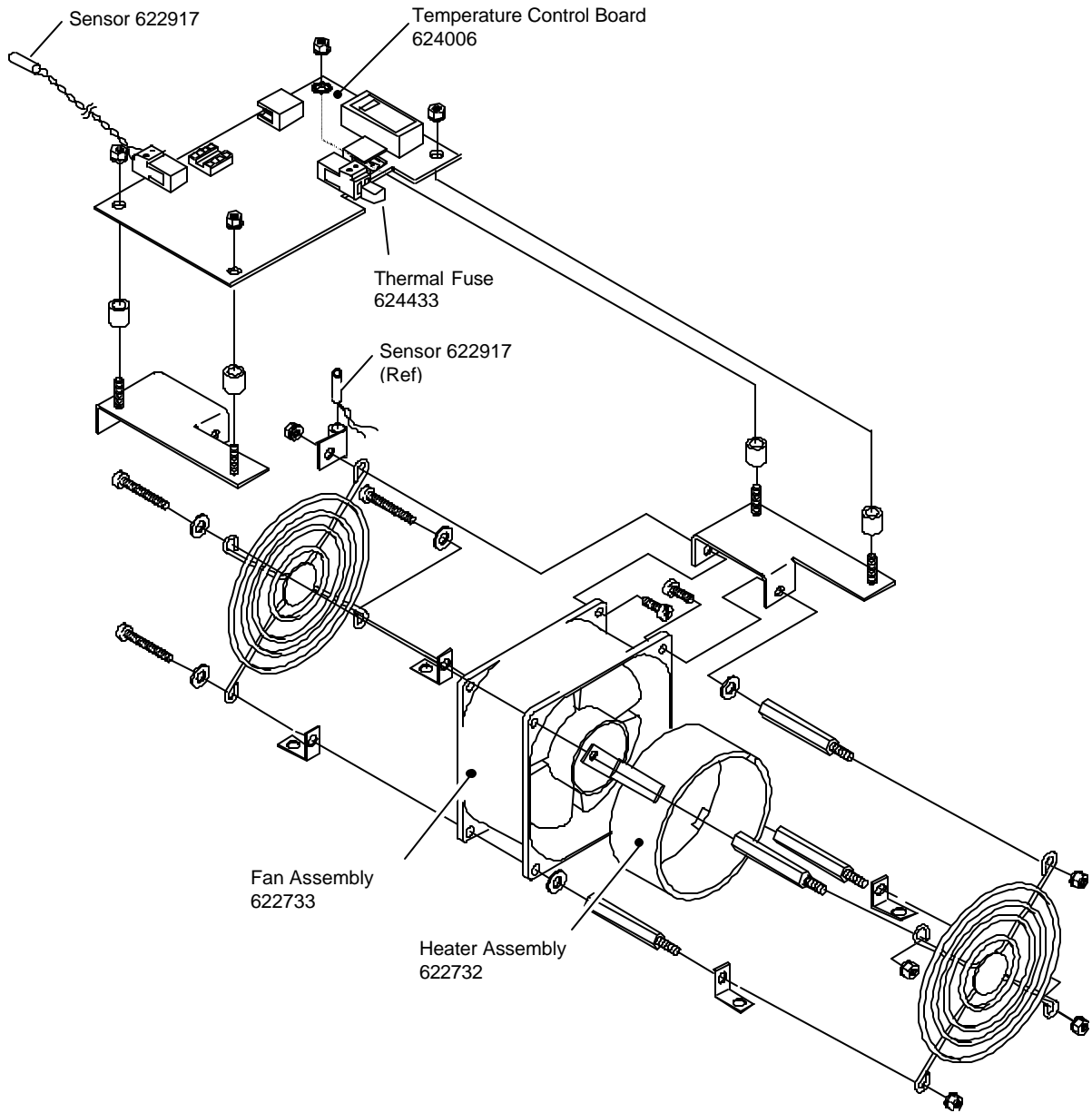


Figure 6-3. Temperature Control Assembly

SECTION 7 RETURN OF MATERIAL

7-1 RETURN OF MATERIAL

If factory repair of defective equipment is required, proceed as follows:

1. Secure a return authorization from a Rosemount Analytical Inc. Sales Office or Representative before returning the equipment. Equipment must be returned with complete identification in accordance with Rosemount instructions or it will not be accepted.

Rosemount CSC will provide the shipping address for your instrument.

In no event will Rosemount be responsible for equipment returned without proper authorization and identification.

2. Carefully pack the defective unit in a sturdy box with sufficient shock absorbing material to ensure no additional damage occurs during shipping.
3. In a cover letter, describe completely:
 - The symptoms that determined the equipment is faulty.
 - The environment in which the equipment was operating (housing, weather, vibration, dust, etc.).
 - Site from where the equipment was removed.
 - Whether warranty or non-warranty service is expected.
 - Complete shipping instructions for the return of the equipment.
4. Enclose a cover letter and purchase order and ship the defective equipment according to instructions provided in the Rosemount Return Authorization, prepaid, to the address provided by Rosemount CSC.

**Rosemount Analytical Inc.
Process Analytical Division
Customer Service Center
1-800-433-6076**

If warranty service is expected, the defective unit will be carefully inspected and tested at the factory. If the failure was due to the conditions listed in the standard Rosemount warranty, the defective unit will be repaired or replaced at Rosemount's option, and an operating unit will be returned to the customer in accordance with the shipping instructions furnished in the cover letter.

For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

7-2 CUSTOMER SERVICE

For order administration, replacement Parts, application assistance, on-site or factory repair, service or maintenance contract information, contact:

**Rosemount Analytical Inc.
Process Analytical Division
Customer Service Center
1-800-433-6076**

7-3 TRAINING

A comprehensive Factory Training Program of operator and service classes is available. For a copy of the *Current Operator and Service Training Schedule* contact the Technical Services Department at:

**Rosemount Analytical Inc.
Customer Service Center
1-800-433-6076**

WARRANTY

Goods and part(s) (excluding consumables) manufactured by Seller are warranted to be free from defects in workmanship and material under normal use and service for a period of twelve (12) months from the date of shipment by Seller. Consumables, glass electrodes, membranes, liquid junctions, electrolyte, o-rings, etc., are warranted to be free from defects in workmanship and material under normal use and service for a period of ninety (90) days from date of shipment by Seller. Goods, part(s) and consumables proven by Seller to be defective in workmanship and/or material shall be replaced or repaired, free of charge, F.O.B. Seller's factory provided that the goods, part(s) or consumables are returned to Seller's designated factory, transportation charges prepaid, within the twelve (12) month period of warranty in the case of goods and part(s), and in the case of consumables, within the ninety (90) day period of warranty. This warranty shall be in effect for replacement or repaired goods, part(s) and the remaining portion of the ninety (90) day warranty in the case of consumables. A defect in goods, part(s) and consumables of the commercial unit shall not operate to condemn such commercial unit when such goods, part(s) and consumables are capable of being renewed, repaired or replaced.

The Seller shall not be liable to the Buyer, or to any other person, for the loss or damage directly or indirectly, arising from the use of the equipment or goods, from breach of any warranty, or from any other cause. All other warranties, expressed or implied are hereby excluded.

IN CONSIDERATION OF THE HEREIN STATED PURCHASE PRICE OF THE GOODS, SELLER GRANTS ONLY THE ABOVE STATED EXPRESS WARRANTY. NO OTHER WARRANTIES ARE GRANTED INCLUDING, BUT NOT LIMITED TO, EXPRESS AND IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Limitations of Remedy. SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF WARRANTY SHALL BE LIMITED TO REPAIR OR REPLACEMENT UNDER THE STANDARD WARRANTY CLAUSE. IN NO CASE, REGARDLESS OF THE FORM OF THE CAUSE OF ACTION, SHALL SELLER'S LIABILITY EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED BY SELLER GIVING RISE TO THE CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY EXTEND TO INCLUDE INCIDENTAL OR CONSEQUENTIAL DAMAGES. CONSEQUENTIAL DAMAGES SHALL INCLUDE, BUT ARE NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS, LOSS OF USE, LOSS OF REVENUE, COST OF CAPITAL AND DAMAGE OR LOSS OF OTHER PROPERTY OR EQUIPMENT. IN NO EVENT SHALL SELLER BE OBLIGATED TO INDEMNIFY BUYER IN ANY MANNER NOR SHALL SELLER BE LIABLE FOR PROPERTY DAMAGE AND/OR THIRD PARTY CLAIMS COVERED BY UMBRELLA INSURANCE AND/OR INDEMNITY COVERAGE PROVIDED TO BUYER, ITS ASSIGNS, AND EACH SUCCESSOR INTEREST TO THE GOODS PROVIDED HEREUNDER.

Force Majeure. Seller shall not be liable for failure to perform due to labor strikes or acts beyond Seller's direct control.

Instruction Manual

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Model 7D

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